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VARIATION IN FEMALE HPV VACCINATION AMONG NOVEL NATIVE-IMMIGRANT ATTRIBUTES: IMPLICATIONS FOR CULTURAL UNIFORMITY

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ABSTRACT

Research estimates that 70% of women will be infected with the human papillomavirus (HPV) within the five years succeeding their first sexual experience. Since 2006, girls and women have obtained the HPV vaccine to protect themselves against cancerous cells and the most common sexually transmitted disease worldwide. While the vaccine has emanated support in the health care community, rates of vaccination fall well under anticipated levels. The current study aimed to identify correlates of vaccine obtainment and three-dose completion in a sample of high-risk females age 10-17, and reveal whether immigrant differentials alter said outcomes. Significantly missed opportunities exist in HPV vaccination among immigrant females who are disproportionately burdened by cervical cancer. This study is unique in being the first to address generational status as a conceivable pathway through which HPV vaccine rates differ in the U.S. Data from the 2007 National Survey of Children's Health was analyzed using multivariate logit regression, chi-square analyses, ANOVA, and t-tests. Results revealed that most correlates contributed directly or indirectly to vaccine behavior. Uptake (15.5%) of the vaccine was low. Of females who initiated, 31% completed the full three-dose vaccine series. Categorizing females according to generational status exposed more marked disparities in care access and utilization than in vaccine behavior. Cross-cultural vaccine associations were most revealing among racial groups as opposed to nativity. Females recommended by their provider to receive the vaccine had nearly 15 times greater odds of obtaining at least one vaccine dose than those without similar communication. Bridging the disparate gap between native-immigrant populations in HPV vaccine research has the potential to expedite cultural uniformity among women by increasing uptake; leading to fewer HPV infections, cervical cancer diagnoses, and ultimately saved lives.

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INTRODUCTION

Globally, the human papillomavirus (HPV) is the most common sexually transmitted infection. HPVs involve a plethora of 150 viruses known to invade the body's epithelial cells of the skin, mouth, and genitals (Centers for Disease Control and Prevention [CDC], 2013). The genital human papillomavirus defines about 40 of these viruses, and is predominantly transmitted through sexual contact: primarily skin-to-skin contact during vaginal, anal, and oral sex (CDC, 1999). Sexually active men and women are likely to be infected with genital HPV(s) at some point in their lives (CDC, 2013). No symptoms are clear upon infection, so genital HPV(s) is spread frequently and unknowingly, fueling HPV's reputation as the most prevalent sexually transmitted infection in the U.S. (CDC, 2013). Unlike HPVs that are low-risk, meaning non-cancerous but produce skin warts, high-risk HPVs can cause cervical and oral cancers if the body does not rid itself of the virus (CDC, 2013).

Public health implications of HPV have captured attention in the U.S. since vaccination for the virus was authorized in 2006 to minimize the burden of HPV and its associated cancers. Namely, the Food and Drug Administration (FDA) approved Gardasil and Cervarix, two vaccines given throughout six months (CDC, 2013). Gardasil, a quadrivalent vaccine designed to protect against four HPV types 6, 11, 16 and 18, is given as a series of three injections; the second vaccination should be received one to two months after the first, and the third vaccination six months after initiation (CDC, 2013). Although the first and second dose of the Gardasil vaccine is still preventive, the duration of protection and efficacy offered by incomplete immunization, less than three doses, is currently unknown according to Widdice and colleagues

(2011), who stress the importance of the three-dose completion within the recommended time frame.

As one of the most successful and least expensive of all public health interventions, vaccination has become a popular remedy to lowering infection (Salmon, 2003). However, HPV vaccine benefits for women's health purposes may be offset if little is known about the vaccine among adolescent females in the U.S. who are at particularly high risk. The U.S. government has noted this risk group, as HPV vaccination priorities have been identified in Healthy People 2020 objectives. Priorities include expanding vaccination coverage among adolescents (IID-11), which entails increasing completion of the required three doses for females between ages 13 and 15 ("Immunization," 2013). The overarching Healthy People 2020 objective is to fully vaccinate 80% of females in the United States, a substantial increase from 16.6% coverage in the U.S. in 2009 (CDC, 2013; "Immunization," 2013). Also included are sexually transmitted disease objectives such as lowering the proportion of females with an HPV infection (C-4), and decreasing invasive uterine cervical cancer rates by 10% [C-10] ("Immunization," 2013).

Neglect in distinguishing between immigrant and non-immigrant children within numerous studies in health care leaves an inability to recognize dissimilarities in health care access, utilization, and needs between U.S. and foreign-born children. For instance, cervical cancer is particularly prevalent among immigrants in the United States (Barnack-Tavlaris, Garcini, Macera, Brodine & Klonoff, 2014; Gerend & Magloire, 2008; Ferlay et al., 2010; Singh & Miller, 2004). This prevalence is concerning given that those who immigrate to the U.S. have substantially lower HPV awareness and vaccine completion rates than whites (Gerend & Magloire, 2008; Tiro, Meissner, Kobrin, & Chollette, 2007). Many immigrant women carry an elevated risk from their home countries, as cervical cancer is one of the most frequent causes of

cancer morbidity and mortality among women worldwide (Ferlay et al., 2010). Comparatively, research has illustrated a substantial lack of HPV and cervical cancer education available in Haitian immigrant populations (Kobetz et al., 2011).

Higher prevalence of HPV infection has been found in numerous studies among those who belong to minority racial/ethnic groups (Bastani et al., 2011; Bynum, Brandt, Sharpe, Williams, & Kerr, 2011; Dunne et al., 2007; Forhan et al., 2009; Marchand, Glenn, & Bastani, 2013; Kobetz et al., 2011). For instance, research reveals that non-Hispanic black women have poorer sexual health outcomes in many realms, including higher rates of HPV infection and cervical cancer mortality rates than their white counterparts (Forhan et al., 2009; Marchand et al., 2013).

Given the challenges that exist in offering a multi-dose vaccine, especially for the most vulnerable populations, this study examines rates of three-dose HPV vaccine series completion among females who initiated the series. Not only do high-risk populations face significant barriers to vaccination, the three-dose HPV vaccine requirement poses structural barriers as it relates to access, cost, and transportation (CDC, 2013). To further investigate predictors as to why female immigrants in the United States age 10-17 initiated or completed the HPV vaccine series, the following question will be examined among various socioeconomic and demographic factors: Is generational status associated with uptake and initiation/completion of the HPV vaccine series among female adolescents in the United States?

A great deal of literature outlines the health barriers of HPV vaccination among adolescent females in the United States, but zero is known about the relationship, if any, between generational status and HPV vaccine behavior. This study adds to the current knowledge on HPV vaccine uptake for foreign-born populations by analyzing a wider range of correlates than those

examined in the literature thus far. To this author's knowledge, no studies have examined the effects of generational status on HPV vaccination rates using nationally representative data.

BACKGROUND

HPV Immunology and Efficacy

Cervical cancer is the second most common female tumor worldwide and its incidence is high (>80%) in the developing world (Scarinci et al., 2010). In the U.S. alone, more than 60% of all cases occur in medically disadvantaged populations (Scarini et al., 2010). Owing to the fact that carcinogenic HPV infections type 16 and 18 cause virtually all cervical cancer diagnoses (70%), vaccination to prevent infections in adolescents have developed significantly (CDC, 2012; Scarinci et al., 2010). That being the case, the fact that cervical cancer is the second most common cancer worldwide is largely a result of the nearly ever-present exposure to HPV after one's first sexual experience (Oliver, 2013; Scarinci et al., 2010). For instance, women with persistent carcinogenic HPV infections are at risk of developing pre-cancer (CDC, 2012), although not all persistent infections progress to pre-cancer (Oliver, 2013). Yet if such pre-cancer is not identified and treated quickly, a significant proportion of pre-cancer HPV infections can invade the body to deadly proportions (Oliver, 2013).

HPV and Cervical Cancer

HPV types 16, 18, 31, and 45 are the most common strains for cervical cancer diagnoses (Jemal et al., 2013). Specifically, HPV types 16 and 18 account for 70% of cervical cancers and 50% of precancerous lesions worldwide (Jemal et al., 2013). Cervical cancers are divided into two categories: squamous cell cancers and adenocarcinomas (CDC, 2013). HPV types 16 and 18

are two high-risk types that are found in high-grade cervical lesions, and are linked to 68% of squamous cell cancers and 83% of adenocarcinomas (CDC, 2013).

Other HPV-Associated Cancers

Cervical cancer aside, the human papillomavirus can be life threatening in its development of the following cancers: vaginal, vulvar, penile, anal, and oropharyngeal (Fernandez et al., 2013; Liddon, Leichliter, & Markowitz, 2012; Oliver, 2013). Notably, anal cancer and oropharyngeal cancer rates increased significantly between 2000 and 2009 (Jemal et al., 2013). The average annual percent change for anal cancers has had a statistically significant increase for white men (Dunne et al., 2007), white women (3.7%), black men (5.6%), and black women (2.5%) [Jemal et al., 2013]. Similarly, oropharyngeal cancers have significantly increased for white men and women (Jemal et al., 2013). Thus, the prevention of HPV by way of vaccination is necessary now more than ever to lower such cancer rates among all vulnerable populations.

Available Vaccines and Efficacy Measures

FDA-approved Gardasil and Cervarix, two prophylactic vaccines given in three doses over six months in preventing HPV-type-related cervical cancer and anogenital warts, are also known as quadrivalent “HPV4” (Gardasil), and bivalent “HPV2” (Cervarix) [CDC, 2009]. In other words, Gardasil, authorized on June 8, 2006, prevents infections of two HPV high-risk types 16 and 18, as well as two low-risk types 6 and 11; while Cervarix, approved by the FDA

on October 16, 2009, prevents infections of just two types 16 and 18 (Chou, Krill, Horton, Barat, & Trimble, 2011; Morbidity and Mortality Weekly Report [MMWR], 2007; MMWR, 2010; Widdice et al., 2011). Considering this, the bivalent vaccine (prevention of two HPV strains), Cervarix, has been shown to provide a higher immune response to HPV types 16 and 18, the two most common oncogenic HPV types, than the quadrivalent vaccine (prevention of four strains of HPV), Gardasil (MMWR, 2010). So much so that, neutralizing antibody titers against types 16 and 18 were between 4 and 9 times higher in women who received the bivalent vaccine in a recent study (MMWR, 2010).

Vaccine Dosage Recommendations

In 2007, the CDC Advisory Committee on Immunization Practices (ACIP) recommended routine vaccination of adolescent females 11- to 12-years-old (Chou et al., 2011). The vaccine is accepted for females as young as 9 in order to increase rates of complete vaccination before their first sexual encounter (Chou et al., 2011; CDC, 2012). Particularly, the peak prevalence of HPV in women is within five to seven years of their first sexual experience; the median age of sexual activity being 17 years old in the U.S. (Scarinci et al., 2010). What is more, a 2009 Youth Behavioral Risk Survey showed that 5.9% of respondents had their first sexual experience before age 13 (Vadaparampil et al., 2011). Given this knowledge, HPV prevention strategies must be age-appropriate so as to maximize health benefits.

Vaccine Efficacy in the United States

HPV vaccines have shown greater than 90% efficacy for up to five years in preventing persistent HPV infections and precancerous lesions from the targeted strains (CDC, 2013). In a 2013 study, Oliver reviewed National Health and Nutrition Examination Surveys (NHANES) data to determine the vaccine's efficacy thus far in the U.S. (2013). Findings indicated that vaccine-type HPV prevalence fell from 11.5% in the pre-vaccine era (2003-2006) to 5.1% in the vaccine era (2007-2010) [Oliver, 2013]. Yet efficacy can only be highest with complete protection of the three vaccine doses, which is challenged by significant barriers given factors such as one's cultural identity, to be explored further throughout this study.

Female Adolescents and HPV

HPV infection is a major health concern among women, as the latest research estimates that 1.5 million American women currently have an HPV-associated disease (Geshnizjani, Jozkowski, & Middlestadt, 2013). Not to mention an estimated 80% of sexually active females will be exposed to HPV before they reach 50 years old (Fernandez et al., 2013). Additionally, approximately 70% of sexually active young women will be infected with HPV, most likely within the five years succeeding their first sexual experience (Lindley, Elkind, Landi, & Brandt, 2013).

In the U.S., adolescents are particularly vulnerable to HPV infection. Not only is this cohort at higher risk of acquiring HPV than any other age group (CDC, 2012; Oliver, 2013), but of the new HPV infections each year, almost half are found among adolescents age 15-24; despite this group making up one quarter of the sexually active population (CDC, 2012).

Consequently, a recent study showed that as little as 21% of young women perceive themselves at risk for HPV infection (Oscarsson, Hannerfors, & Tyden, 2012). Another study found that females age 13-18, 19-26, and ≥ 27 were less likely than those ages 9-12 to complete the HPV vaccine series (Hirth, Tan, Wilkinson, & Berenson, 2012). Additionally, the same study by Hirth and colleagues found that females age 9-12 and 13-18 had lower odds of completing the HPV vaccine series for each subsequent year compared with those age 19-26 years and ≥ 27 (2012). These findings reveal that the percentage of females who complete the HPV vaccine series is dropping over time, especially among adolescent females most frequently targeted to receive the vaccine.

Immigrant Factors

The immigrant population in the United States has grown considerably over the past 36 years: in 2006, there were 37.5 million immigrants, an increase of 27.9 million since 1970 (CDC, 2009). Today, immigrants account for more than 12.6% of the total U.S. population (CDC, 2009). Additionally, the proportion of U.S. children living with at least one foreign-born parent rose from 12% in 1990 to 21% in 2006 (Johnson, Mues, Mayne, & Kiblawi, 2008). Given such a rapid increase in the immigrant population coupled with the prevalence of HPV, the literature to date reveals a growing importance of how vaccinations for this segment of the U.S. population differ from those of the majority native-born population (CDC, 2009; Ferlay et al., 2010; Grandahl, Tydén, Gottvall, Westerling, & Oscarsson, 2012; Singh & Miller, 2004).

Almost one quarter of children in the United States have at least one foreign-born parent (Yun, Fuentes-Affick, Curry, Krumbolz, & Desai, 2013), and this cohort represents the fastest

growing group of American children (Fortuny & Chaudry, 2009). Subsequently, immigrant families are substantially diverse in nationality, socioeconomic status, and educational background. A comprehensive understanding of health among immigrant children and those in immigrant families remains limited. Previous studies have reported that children in undocumented families are more likely to be uninsured and in poor health, and lack a usual source of care relative to children in documented immigrant or non-immigrant families (Javier, Huffman, Mendoza, & Wise, 2010; Fortuny & Chaudry, 2009). Furthermore, one study found that immigrant women accepted HPV vaccination for their daughters but expressed difficulties in understanding information from health-care providers (Grandahl et al., 2012). This finding indicates the importance of clear information exchange, as well as how vital it is for health professionals to consider immigrant women's cultural challenges when seeking vaccination.

Foreign birthplace may explain disparities in vaccination, and is a significant barrier to cancer screening. In view of this, evidence has shown that immigrants have lower screening rates for cervical, breast, and colorectal cancer (Schulmeister & Lifsey, 1999; Maxwell, Bastani, & Warda, 2000). Studies also suggest that immigrants may experience barriers to care unique from their native-born counterparts (Schulmeister & Lifsey, 1999; Juon, Choi, & Kim, 1999; Javier et al., 2010; McPhee et al., 1997; Coughlin & Uhler, 2002; Singh & Miller, 2004). Lower rates of screening among foreign-born patients, seen in the literature, raise concerns that inconsistency in HPV vaccine completion could worsen existing disparities in cervical cancer within this group.

Generation differentials among native-immigrant populations are limited in research, but of those conducted, have shown substantial effects on health care. To start, evidence from Viruell-Fuentes's study suggests that despite their lower socio-economic status, certain health outcomes are more favorable for first-generation Mexican immigrants than for their U.S.-born

counterparts (2007). Subsequently, Burgos and colleagues found in their study of generational status and health care utilization for Mexican American children, that more than two thirds were poor and uninsured, and had parents with low educational attainment (Burgos, Schetzina, Dixon, & Mendoza, 2005). Comparatively, more than one fourth of first-generation children were perceived as having poor or fair health, despite experiencing similar rates of illnesses as compared with children in the same study (Burgos et al., 2005). That being the case, more first-generation children had not seen a doctor in the past year as compared with second or third generation children (Burgos et al., 2005). Additionally, perceived health status among first-generation children was worse than for all other groups, altogether revealing that first generation children fared substantially worse than second- or third-generation children.

U.S. immigrant health is impacted by socioeconomic and cultural factors, including but not limited to acculturation, language barriers, and lack of access to health care (Edberg, Cleary, & Vyas, 2011; Moonesinghe, Zhu, & Truman, 2011; Singh & Miller, 2004). In actuality, foreign-born individuals are less likely to obtain Pap smears, fecal occult blood testing, sigmoidoscopy, and mammography than their U.S.-born counterparts (Goel et al., 2003). Despite these facts, U.S. research does not often examine disparities across socio-demographic characteristics (such as race/ethnicity), let alone generational status. Therefore, greater attention must be paid to immigrants in the study of HPV to best understand the gap in health care utilization by way of vaccination.

Parental immigration status is an important aspect of a child's health status, yet has been considered in few studies. For example, one study found that undocumented immigrant parents' fear of discovery by authorities discouraged their seeking pediatric care (Hagan, Rodriguez, Capps, & Kabiri, 2003). Similar results were recently found among immigrant mothers with low

socio-economic backgrounds in the United States, within a study by Grandahl and colleagues (2012). For brevity, these results revealed a mere 11% of immigrant mothers accepted HPV vaccination for their daughters; lack of knowledge being cited as the main barrier (Grandahl et al., 2012).

Health care providers and policy makers must be cognizant of the various sociocultural factors influencing health-related beliefs and care utilization among immigrant and ethnic minorities in the U.S. Previous research as seen in literature outlined thus far within the current study, suggests that immigrants may experience unique barriers to care (Schulmeister & Lifsey, 1999; Juon et al., 1999; McPhee et al., 1997; Coughlin & Uhler, 2002). Namely, foreign-born individuals are more likely to encounter language and cultural barriers, which have shown to impact communication with providers (Goel et al., 2003). Characteristics of one's provider such as gender and ethnicity may even be a factor in care utilization, as seen in studies demonstrating that Asian Americans and Pacific Islander (AAPI) women cared for by female or non-AAPI physicians have higher rates of cervical and breast cancer screening (Goel et al., 2003). Whether these factors are important among non-AAPI immigrant groups is unclear, and all the more important to investigate.

Purpose of Study

Understanding adherence to the recommended HPV vaccination schedule and identifying factors that predict initiation versus completion among females age 10-17 are vital in the enhancement of public health practices to increase cross-cultural vaccination coverage in the U.S. In terms of vulnerable and understated immigrant populations, evidence-based strategies to

improve immigrant vaccine coverage rely mainly on studies of statewide vaccination (Briss et al., 2000; Barnack-Tavlaris et al., 2014; Constatine & Jerman, 2007; Johnson et al., 2008). That being the case, identifying factors that predict HPV vaccine uptake and general characteristics among native and generationally differentiated adolescents on a nationwide scale, are necessary if we wish to increase vaccine rates to Healthy People 2020 priority levels in the U.S. With this intention, the purpose of this study is to (1) estimate the prevalence of obtainment and initiation/completion rates for the HPV vaccine among immigrant and U.S.-born adolescent females age 10-17 after adjusting for age, gender, race/ethnicity, and demographic/socioeconomic factors; and (2) to determine the extent to which all factors vary by generational status.

REVIEW OF THE LITERATURE

While much evidence exists about the health burdens of HPV vaccination among adolescent females in the United States, little is known about how immigration measures such as generational status impacts HPV vaccination uptake and completion. Therefore, the following review of the literature will outline the relationship between vaccine obtainment within at-risk populations in the United States and provide a background necessary to discern the relationship between HPV vaccination behavior and immigrant populations.

Recent data from the U.S. National Immunization Survey indicates that only 49% of 13-17 year-olds received one or more doses of the HPV vaccine, and 32% received all three recommended doses (Perkins, Brogly, Adams, & Freund, 2012). Effects of demographic factors on such rates, including race and socioeconomic status, are inconsistent, as will be seen in the following review.

Abundant research suggests that women at high risk of cervical cancer either do not have adequate access to preventive services or choose not to utilize these services for a number of reasons, cultural and otherwise. With this in mind, public health interventions that consider cultural beliefs, attitudes and behaviors aimed at increasing knowledge about HPV and its link to cervical cancer, cervical cancer screening, and HPV vaccination uptake may represent a promising approach to minimizing disparities that exist in high-risk populations.

The health, social, and behavioral characteristics of immigrants differ substantially from similar characteristics of their U.S.-born counterparts (CDC, 2009; Grandahl et al., 2012). Granted, U.S.-born females and foreign-born females are two unique groups, differentiated by nativity, especially in determining health outcomes and disease risk. Although U.S. born and foreign-born female adolescents are at high-risk for HPV infection, first generation immigrant females who are entirely foreign-born, or second-generation immigrants whose parents were both born outside of the U.S., are particularly vulnerable with respect to infection (Grandahl et al., 2012; Drewry, Garces-Palacio, & Scarinci, 2010).

With heightening concern over health disparities, researchers have focused on factors related to low obtainment of HPV vaccination among immigrant women. In Grandahl's study of women immigrants' views on prevention of cervical cancer, several barriers were identified: difficulties in contacting health care providers due to language problems, limited knowledge regarding the relation between sexual transmission of HPV and cervical cancer, and unfamiliarity with regular health check-ups (2012). The following literature will further investigate these barriers.

In literature to date, researchers have paid little attention to country of origin as it relates to HPV vaccination uptake. Some researchers who have studied immigrant populations have found low HPV vaccine awareness (Drewry et al., 2010; Nguyen, Chen, & Chan, 2012), but had no comparison to U.S.-born counterparts. Seeing that foreign-born women have reported positive attitudes and support of other types of vaccines (Kobetz et al., 2011), an introspective look into the barriers causing low uptake of the HPV vaccine in particular, and among immigrants, may increase vaccination for such populations.

HPV Vaccination Rates Among Immigrants

Available research on the uptake of HPV vaccination among immigrant female adolescents is rare and largely limited to statewide data (Barnack-Tavlaris et al., 2014). Of the literature conducted, overall awareness of the HPV vaccine among foreign-born women is lower than their native-born counterparts in the U.S. (Barnack-Tavlaris et al., 2014; Johnson et al., 2008). For instance, statewide data from California in a study by Barnack-Tavlaris revealed that foreign-born women and mothers were less aware of the HPV vaccine than their U.S.-born counterparts (2014). Yet level of interest in vaccination did not follow suit, as the same study also found that foreign-born young adult Latinas were more interested in the HPV vaccine than their U.S.-born counterparts (Barnack-Tavlaris et al., 2014).

In another California study conducted soon after FDA approval of HPV vaccination, overall acceptance rates for the HPV vaccine were high with 75% of parents likely to vaccinate a daughter under age 13 (Constatine & Jerman, 2007). Latino/a parents were most accepting of HPV vaccination, and African American and Asian American parents were less accepting (Constatine & Jerman, 2007). However, non-English speaking individuals were excluded from the data, and like in Drewry (2010) and Nguyen's studies (2012), U.S.-born status was not assessed.

Cervical Cancer Screening Rates Among Immigrants

Following systematic review of studies examining sociocultural factors influencing cervical cancer screening among immigrants in the United States, a few significant findings emerged. For instance, small studies of racial and ethnic subgroups comprised largely of

immigrants showed that immigrants have lower cancer screening rates than non-immigrants (Goel et al.,2003; Fox & Alba, 1998; Schleicher, 2007). In particular, Hispanics, Asian Americans and Pacific Islanders have lower screening rates than whites for cervical, breast, and colorectal cancers (Coughlin & Uhler, 2000; Coughlin & Uhler, 2002; Fulton, Rakowski, & Jones, 1995; Perez-Stable, Otero Sabogal, Sabogal, Mcphee, & Hiatt, 1994).

Several cultural groups have cited barriers to cancer screening, including lack of knowledge about cervical cancer, fear of Pap smears threatening one's virginity, and the idea that a Pap smear is unnecessary unless one is ill, according to research by Johnson and colleagues (2008). In the same study, blacks viewed administrative processes as barriers to screening, whereas Asian immigrants held a variety of misconceptions concerning one's susceptibility to cancer, most often stigmas imposed by their community and health providers (Johnson et al., 2008).

Vaccination, Screening, and Adherence Among Ethnic Minorities

Health disparities exist within cervical cancer and HPV incidence/mortality rates for racial and ethnic minority populations. As such, disparities have been demonstrated across race/ethnicity in several studies (Bruno, Wilson, Gany, & Aragones, 2014; Pruitt & Schootman, 2010; Marchand et al., 2013; Perkins et al., 2012; Chao, Velicer, Slezak, & Jacobsen, 2010; Joseph et al., 2012; Niccolai, Mehta, & Hadler, 2011). Due to higher rates of HPV infection and lower use of screening and treatment services in Latina and African American women, cervical cancer incidence and mortality rates are nearly twice as high in Latina and African American women as in white women (Perkins et al., 2012; Warner et al., 2014). Relatedly, HPV prevalence

and cervical cancer mortality has been found to be higher in non-Hispanic blacks versus whites (Dunne et al., 2007; Forhan et al., 2009). In addition, research has revealed that black women have poorer sexual health outcomes in many domains, including higher rates of sexually transmitted diseases (Marchand et al., 2013). Such findings indicating lower rates of vaccination among minority women, particularly black and Hispanic women, are concerning given the higher risk of HPV-linked diseases, especially cervical cancer, among these populations (Lindley et al., 2013; Marchand et al., 2013).

Higher prevalence to HPV infection has been found among women who belong to specific racial/ethnic groups, but ethnic differences in actual vaccine uptake have been examined in only few studies with mixed outcomes. In this way, some studies found evidence for ethnic differences in vaccine initiation, whereas others report no differences. For example, Pruitt and Schootman (2010) showed that ethnic minority females were less likely to have received the HPV vaccine than non-Latino/a whites, whereas Chao and colleagues (2010) reported that Latina females were more likely to receive the vaccine as compared to other ethnic groups.

Vaccine Initiation and Completion

The CDC reported that in 2009, 44.3% of eligible adolescent females age 13-17 initiated the HPV vaccine series, and only 26.7% completed the three-dose vaccination series (CDC, 2012). Uptake rates seen in smaller studies on specific subgroup populations have varied widely but still reflect suboptimal utilization (e.g., 26% to 47%), depending on sample characteristics, recruitment methods, and the timing of data collection (Chou at al., 2011; Cook et al., 2010;

Rahman, Laz, McGrath, & Berenson, 2014; Laz, Rahman, & Beenson, 2012; Reiter, 2014; Schluterman, Terplan, Lydecker, & Tracy, 2011; Perkins et al., 2012).

Over the past several years, vaccination initiation and completion rates have lacked consistency. According to a study by Cook and colleagues, for example, of 9.4% of females age 11-18 years who did receive an HPV vaccination, only 1.8% had completed the three-dose series (2010). Furthermore, Chou and colleagues (2011) found that 33.2% completed the vaccine series and cited that other studies have reported completion rates ranging from 13% to 58% among those who initiated the vaccine series.

A recent study showed that HPV vaccine uptake among 11- to 17-year-old females in the U.S. was 14.2% for all three doses, with 3.0% among 11- to 12-year-old girls, and 18.7% among 13- to 17-year-olds (Laz et al., 2012). Additionally, only 1 out of 3 girls age 11-17 had received ≥1 dose of HPV vaccine. In yet another study, of 41% of adolescent girls who initiated HPV vaccination, about half (20%) completed the series (Perkins et al., 2012). Reiter had similar findings, in that HPV vaccine initiation was 60.9%, but completion occurred in just over half of the initiators at 36.0% (2014). In Schluterman and colleagues' study, younger girls were more likely to initiate the vaccine series, (91% of those age 9-13), but only 33% of the 9-13 age group completed the three dose series (2011). Perkins and colleagues (2012) had a similar finding, showing a higher proportion of 11- to 18-year-old females (about 47%) initiating vaccination than those ages 18-21 (28%).

Prevalence of Initiation and Completion Rates Among Immigrant Populations

From data examining immigrant, low-income mothers of adolescent females, only 27% of girls initiated the vaccine (Tsui et al., 2013). Reiter found similar results, in that vaccine completion was less common among daughters who had moved from their birth states than that of their U.S.-born counterparts (2014).

Prevalence of Initiation and Completion Rates By Race/Ethnicity

Racial and ethnic minorities bear a large burden on HPV initiation rates as a result of several factors. For instance, in a recent study by Bednarczyk and colleagues, black women were 33% less likely to have initiated HPV vaccination than whites (Bednarczyk, Birkhead, Morse, Doleyres, & McNutt, 2011). Yet several studies have shown no evidence of a racial-ethnic disparity in vaccination rates (Pruitt & Schootman, 2010; Perkins et al., 2012). For instance, available data indicates that race does not predict initiation of the HPV vaccine series, but minorities have been found to be less likely than whites to complete the series in the United States (Perkins et al., 2012; Chou et al., 2011).

In a study of adolescents at a school-based health center in Oregon, Gold and colleagues found in that in 2007, about half of the participants had received all three doses of the HPV vaccine, with whites having the highest rate of completion at 56% compared to blacks at 38% (2011). In a similar study, after adjustment for insurance, blacks were less than half as likely as whites to complete the series in all age groups and had 0.35 the odds of adherence (Schluterman et al., 2011). Cook and colleagues also found that in comparison with their white counterparts, black females were approximately half as likely to complete the three-vaccine series after

initiation (2010). Likewise, Laz and colleagues found that Hispanics had higher uptake of at least one dose of the vaccination than whites (2012). This finding is consistent with another study, in which Hispanic females were more likely to initiate vaccination as compared to all other racial groups in the study (Cook et al., 2010).

Correlates of Vaccine Uptake

Regardless of race and ethnicity, other barriers exist to vaccination, such as medical insurance coverage, provider type, and limited access and knowledge of the HPV vaccine (Liddon et al., 2012; Lindley et al., 2013). A California statewide study by Barnack-Tavlarlis found that being younger, unmarried, sexually active in past year, having poorer self-reported health, and having heard of the vaccine were associated with higher vaccine acceptability (Barnack-Tavlaris et al., 2014). Similarly, mothers' vaccine acceptability was deemed higher when the mothers were white, insured and/or unmarried, and had obtained Pap tests over the past three years (Barnack-Tavlaris et al., 2014). In another study of Latina/o parents of children age 11-17, the parents reported low HPV vaccine knowledge, high vaccine costs, and lack of strong provider recommendations as the main barriers to vaccine initiation (Warner et al., 2014). The following review will highlight similar correlates of vaccination uptake in the U.S.

Physician Recommendation

Among various factors that may motivate one to become vaccinated, research has also found that physician recommendation is a key ingredient of successful HPV vaccination programs (Marchand et al., 2013) in the physician's abilities to recommend contraception,

describe the HPV vaccine to patients, clarify any misunderstandings about what it protects against, and educate the patients on risks associated with the infection. In this way, failure of providers to discuss vaccination with their patients appears to be an important contributor to low rates of HPV vaccination (Perkins et al., 2012; Vadaparampil et al., 2013; Kobetz et al., 2011; Roland, Bernard, Greek, Hawkins, & Saraiya, 2014; Hirth et al., 2012; Marchand et al., 2013). That is to say, when recommendation is not consistent, missed opportunities result in care. For instance, more than half of the foreign-born parents in Colón-López's study had not received proper HPV vaccine orientation from their healthcare provider (58.3 %) [2014]. In the same study, the HPV vaccination coverage was low (31.7 %) [Colón-López et al., 2014].

Physicians who report always recommending the HPV vaccine for patients age 11 or 12 increased significantly from 2009 to 2011, unlike for patients age 13-17 or 18-26 (Vadaparampil et al., 2014). In this study, physician specialty, age, and perceived issues/barriers to vaccination were associated with vaccine recommendation for patients age 11 or 12 in both 2009 and 2011 (Vadaparampil et al., 2014). Yet Roland and colleagues found that 93% of providers recommended the HPV vaccine most frequently for females age 13-26 years (98%) [Roland et al., 2014].

Initiation and completion of the HPV vaccine is commonly associated with provider recommendation, as deemed from the following studies. For instance, initiation and completion of HPV vaccine doses were more common among older daughters and those whose parents had received a provider recommendation in a study by Reiter (2014). Similarly, Kobetz and colleagues highlight physician recommendation in their study as one reason for vaccination among Hispanics (2011). Notably, in Vadaparampil and colleagues' study, HPV vaccination rates were higher among providers who were pediatricians under the Vaccines for Children

program; furthermore, these providers saw primarily non-Hispanic white patients, used two or more strategies for vaccine series completion, and did not refer out for HPV vaccination (2013). This data supports Vadaparampil and colleagues' finding that of providers who care for 10-17 year olds, pediatricians were most experienced with vaccine administration (2013). Yet Hirth and colleagues found that obstetricians/gynecologists were more likely to administer vaccines to those who complete the vaccine series than pediatricians, whereas clinics, nurses, family care practitioners, and specialists were less likely to administer initial vaccines to completers compared with pediatricians (2012).

Provider personality and behavior may act as an additional impact to vaccinate among adolescents based on the following finding. Providers in a study by Perkins and colleagues described reluctance to vaccinate younger girls because they felt uncomfortable discussing issues related to sexuality, and were concerned about parents' negative reactions (2012). Since such actions and beliefs may be altered over time with interventions to improve provider communication around HPV vaccination, vaccination rates may not suffer entirely for this reason, but is a notable finding (Perkins et al., 2012).

Age and Vaccination

Studies have shown that adolescents play a minimal role in the decision to receive the HPV vaccine (Oliver, 2013). Given that the United States adolescent population is at a higher risk of acquiring HPV than any other age group, barriers and rates of adolescent uptake is important to highlight (CDC, 2012; Oliver, 2013). Furthermore, the percentage of females who

complete the HPV vaccine series is dropping over time, especially among younger females most frequently targeted to receive the vaccine (Hirth et al., 2012)

In multivariable analyses of Chou's study, the combination of younger age (11-17 years) and urban practice location was associated with a very low likelihood of completing HPV vaccination (22%) [Chou et al., 2011]. Notably, the study by Hirth and colleagues found that in females age 9-12, the percentage of initiators who completed the vaccination series dropped from 57.45% in 2006 to 21.15% in 2009. In contrast, among the women ≥ 27, an increase occurred in the rate of completion from 15% in 2006 to 26% in 2007 and 26.63% in 2008 (Hirth et al., 2012). Similarly, Pruitt and Schootman found that older age was associated with greater odds of vaccination (2010).

Barriers in immigrant populations may result for adolescent girls, as well. For example, Kobetz and colleagues found that Haitian immigrant women felt that the HPV vaccine was less appropriate for adolescent girls who are presumed as not sexually active (2011). Relatedly, Grandahl and colleagues found that Swedish immigrant women expressed concern about the age at which their daughters should be vaccinated, citing that they felt it better to wait beyond age 12 when females had become "women" (2012).

Insurance Status

Commonly cited poor health outcomes of vulnerable populations may relate to the phenomenon of disparities in health insurance coverage in the U.S., where medical insurance coverage is a major barrier to vaccination among young women. For instance, the vaccine can cost nearly $400 (Bednarczyk et al., 2011); an absence of insurance to help alleviate these costs

becomes a large barrier to receiving the vaccination. Given the geographic and socioeconomic disparities that exist for uptake of the relatively inexpensive Pap test typically covered by insurance, worsening disparities are likely in the uptake of the costlier HPV vaccination (Pruitt & Schootman, 2010).

In a study by Schluterman and colleagues, the uninsured had much lower race-adjusted odds than insured groups for initiation of the HPV vaccine, but had similar rates of completion (2011). Similarly, all vaccination outcomes were less common among daughters without health insurance, according to a study by Reiter (2014). Insurance status was also a strong predictor for initiation in Tsui and colleagues' study (2013). Furthermore, a federal program known as Vaccines for Children can potentially combat insurance coverage disparities for adolescent females (Pruitt & Schootman, 2010). However, wide gaps in public financing for childhood vaccinations have been documented across U.S. states and are largest for the most expensive and newest vaccines, such as the HPV vaccine (Pruitt & Schootman, 2010).

Acculturation

An important aspect to consider when investigating the association between HPV vaccine initiation and completion among immigrant females is how acculturation moderates the relationship. Acculturation is a process of adjusting to a new language, customs, societal norms, rules, and lifestyle changes (Chun, Organista, & Marin, 2003). In the next several years, a growing number of United States adolescents will face the challenges that accompany integrating oneself within a new culture (Gonzales, Knight, Morgan-Lopez, Saenz, & Sirolli, 2002).

Several aspects of adapting to a new culture, such as acquiring a new language or obtaining a job, may be incredibly stressful and impactful to one's health. Hence, the effects of acculturation on health should be noted during HPV vaccination and cancer prevention screening. A study by Grandahl and colleagues found that the longer the span of acculturation, the higher the participation in cervical cancer screening, which supports the idea that once the challenges of new integration into a new culture subside, barriers to preventive care may decrease for immigrants (Grandahl et al., 2012). However, sociocultural studies have suggested that cultural behaviors and community networks protect the health of the first generation and that, as immigrants acculturate, they lose these health-protecting elements (Viruell-Fuentes, 2007). Researchers recently examined HPV vaccine initiation data from the 2007 California Health Interview Survey and found that young adult women living in the U.S. for less than five years were less likely to have initiated the vaccine series than women living in the U.S. for five or more years (Tiro et al., 2007). Grandahl and colleagues' study also noted difficulty for immigrant females in communicating with health-care professionals, such as clearly explaining their symptoms and problems to health-care professionals, which may be an effect of a lower span of acculturation (2012). Similarly, the women expressed trouble understanding the letter of invitation from their health care provider and were unsure how to contact health-care facilities to make an appointment (Grandahl et al., 2012).

Access to Care

One's access to a usual, consistent source of care has been found to be associated with higher vaccination rates among a wide range of populations. For instance, Perkins and colleagues

found that those with greater access to medical care were more likely to have completed the HPV vaccine series, and more reported overall visits to the doctor were associated with higher initiation and completion rates (2012). In the same study, girls who had a greater documented number of visits to the clinic were more likely to have completed two doses of the HPV vaccine as opposed those who had completed only one dose in the same time frame (Perkins et al., 2012).

The Current Study

The current study investigates novel nationally representative immigrant factors in addition to socio-economic and demographic correlates as it relates to HPV vaccination uptake and completion outcomes among 10-17 year-old females in the U.S. Unlike past studies, the current study tests possible associations among females stratified by generational status (first, second, third) and nativity (immigrant or non-immigrant) with HPV vaccination coverage.

Two main outcome variables were assessed in the current study: The relationship between the variables and (1) whether the sample female obtained the HPV vaccine or not (yes or no), (2) whether the sample female completed all three doses of the vaccine or not. Thus, the study investigated both vaccine uptake as well as completion among sample females.

Hypotheses. The overall research questions that this study attempted to answer were: "What factors influence uptake and completion of HPV vaccinations in a national sample of adolescent females age 10-17; with particular interest in immigrant correlates?" and "Do socio-economic characteristics and health care utilization measures differ by generational status?" The following set of hypotheses was developed to investigate the direct relationships between the predictor variables used in this study, and the outcome variables.

The study hypotheses were:

1. Provider recommendation will predict HPV vaccination, with higher levels of recommendation positively associated with vaccination.

2. Health care utilization measures will influence HPV vaccination; those sample females who have insurance, a usual source of care, a close personal provider, require less care coordination assistance, and obtain needed health care information more easily will have a higher likelihood of being vaccinated.

3. Being white, and a third generation non-immigrant will impact vaccination decisions, predicting higher frequency of HPV vaccination than those who identify as first or second generation immigrants of black, Hispanic, multi-racial or other descent.

4. Acculturation measures will alter HPV vaccination, with higher number of years in the U.S. positively associated with vaccination.

METHODS

Data Source and Study Population

The cross-sectional data for this study was obtained from the 2007 National Survey of Children's Health (NSCH). With funding and guidance from the Maternal Child Health Bureau of the Health Resources and Services Administration and derived from the Data Resource Center for Child and Adolescent Health, NSCH is a nationwide telephone survey that displays information on health-related indicators and services for children and families in the U.S. (Blumberg et al. 2007). The 2007 sample, conducted by the National Center for Health Statistics, was obtained randomly via telephone communication with households of children younger than 18 years from each of the 50 U.S. states and the District of Columbia. Each participant provided informed consent to answer the questions posed in the survey.

A single child was randomly selected as the subject for the interview in each household. Information collected through household interviews includes demographic characteristics, country of birth, utilization of health services, indicators of health status, health insurance status, satisfaction with healthcare, and access to care. A total of 91,642 interviews were nationally conducted from April 2007 to July 2008, in which approximately 80% were completed in 2007 and about 1,800 interviews were collected per state. Interviews were completed in 66% of identified households with children and the weighted overall response rate was 46.7% (Blumberg et al. 2007). The NSCH Research Ethics Review Board approved all data collection procedures; more information on NSCH is available on the Data Resource Center for Child and Adolescent Health website, at http://www.childhealthdata.org.

Participant Sample

The current study included information on a participant sample of 21,975 total females, age 10-17, residing in the United States. Survey questions related to receipt of the HPV vaccine were pinpointed, including number of doses determining initiation or completion, perceived barriers, and relevant socio-economic variables. Overall analyses of immigrant differentials and demographic factors in receipt of HPV vaccine and initiation and completion rates were conducted among female adolescents for whom complete information on HPV vaccine initiation was available. The dataset includes the following variables: gender, race, health care utilization measures, the birthplace of the sample female and her parents, parental education level, and whether or not the sample female had received a recommendation for the HPV vaccine from a health provider, along with many other correlates. The reasons for including these variables are explained in the previous sections. Table 1 (see Appendix A) displays all variables highlighted for this study as well as the summary statistics for each variable.

Study Measures and Variables

Estimates generalize only to the population of U.S. non-institutionalized female children ages 10-17 years at the time of the interview. These estimates do not generalize to the population of parents or health care providers. All measures in which the respondent did not know the answer or refused to provide the answer were assigned a missing value to identify these responses. All measures coded dichotomously are labeled “Yes” (1) and “No (0).

Dependent Variables

Two dependent variables were chosen for this study: whether the sample female had received any number of HPV vaccination doses, and whether the sample female who had initiated the series also went on to complete the three-dose vaccine. The first dependent variable was originally an indicator variable assessing female's receipt of HPV vaccination; "Yes" (1) "No" (2), or "Child is up to date on all shots" (3). Receipt of vaccination was re-coded into a dummy variable in the current study; "Yes, sample female received the HPV vaccine" (1) and "No" otherwise (0), with "Child is up to date on all shots" collapsed into the "Yes" category. The second dependent variable assessed females who initiated or completed the vaccine series. Data regarding the total number of HPV shots received during the study period was re-coded to reflect this variable: "One" (1), "Two" (2), "Three or More" (3), and "All shots that are recommended" (4). For brevity, the re-coded variable was renamed "Frequency," and coded dichotomously as a dummy variable. In other words, if the female had received one or two HPV shots then she was considered to have initiated, but not completed, the vaccine series: values (1) and (2) were collapsed into the "Initiated" (but not completed) (0) category of the Frequency variable. For females who completed the HPV vaccine series after having initiated the series, if the female had received "Three or more" (3) HPV shots, or "All shots that are recommended" (4), then she was considered to have completed the vaccine series: "Completed" (1). In essence, the purpose of this study is to determine what independent variables, namely among immigrant differentials, lead to a positive outcome for receipt of vaccination and vaccine completion.

Independent Variables

Several independent variables were chosen for this study. The four demographic-themed survey questions of interest inquired about participant age, gender, race and Hispanic ethnicity. The child's age in years was recorded when the child was first identified as the sample child, with values 0-17. Values from 0 to 9 were dropped from the current study to ensure only those ages 10-17 were examined. Gender was coded as "Male" (1) or "Female" (2). To restrict the sample to only female adolescents, all "Male" respondents were dropped from the current study. Race, an indicator variable, was coded as "White only" (1), "Black only" (2), "Multi-Racial" (3), and "Other only" (4). The Hispanic variable was a dichotomous variable, including those who identified the sample female as Hispanic, "Yes" (1), or non-Hispanic, "No" (0). The socio-demographic variables considered were measures of health insurance status, and measures of achieved characteristics, parental education level. Health care utilization variables included measures of adequate care and communication when needed, provider recommendation of the HPV vaccine, the frequency that the sample female visited a health care provider for preventative medical care in the past 12 months, if there is a place the sample female goes when sick or in need of health care advice, and if the parent or guardian has one or more person that they think of as this daughter's personal doctor or nurse. Immigrant measures considered included the mother and father's birthplace (U.S. or outside of U.S.), and child's birthplace, all of which were collapsed into two main covariates of interest: an indicator variable revealing generational status (First, Second, Third), and a dichotomous nativity variable (Native-Born or Immigrant). Acculturation variables were also included, identifying the mother, father, and child's number of years in the U.S.

Socio-demographic Measures

Insurance status. In the current study, insurance status of the sample female was derived from the question, "Does the sample female have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicaid?" The variable was coded as "Yes" (1), or "No" (0).

Mother education level. Participants responded to the question assessing education level of the female's mother by indicating the highest grade or year of school that the sample female's mother type had completed by the time of the interview as either "Less than High School" (1), "12 Years, High School Graduate" (2), or "More than High School" (3).

Father education level. The study questionnaire contained a question of the sample females' father type education level, investigating the highest grade or year of school that the sample female's father type had completed by the time of the interview as either "Less than High School" (1), "12 Years, High School Graduate" (2), or "More than High School" (3).

Health Care Utilization Measures

Provider recommendation. Three items assessed whether the sample female's doctor or health care provider recommended that the female receive the HPV vaccine: "Yes," (1) "No" (2), or "Child has not been to the doctor since the vaccine has been approved" (3). The Provider Recommendation variable was re-coded as dichotomous, with the "Child has not been to the doctor since the vaccine has been approved" collapsed into the "No" category.

Number of provider visits. The respondent was asked to identify the number of visits of the sample female to a doctor, nurse, or other health care provider for preventative medical care such as a physical exam or well-child checkup in the past year, with "20 or more" visits as the maximum category released publicly.

Usual source of care. Information on whether a place exists for the sample female wherein she can go to when sick or seeks advice about her health, was gathered with three items, which identified either "Yes" (1), "No" (2), or "There is more than one place" (3). The usual source of care variable was re-coded as dichotomous, with "There is more than one place" included in the "Yes" category.

Personal provider. To assess if there is one or more persons that the parental figure thinks of as the sample female's personal doctor or nurse, three choices were provided: "Yes, one person" (1) "Yes, more than one person" (2), or "No" (3). The personal provider variable was re-coded as dichotomous, with the (1) and (2) "Yes" categories collapsed into a single "Yes" category.

Care coordination. Respondents reported if they had felt that they could have used extra help arranging or coordinating the sample female's care among the different health care providers or services in the past 12 months, to which two choices were provided: "Yes" (1) or "No" (0).

Frequency of needed information. The frequency that the parental figure felt they had received the specific information they needed from the sample female's doctors and other health care providers in the past year was measured with four items: "Never" (1) "Sometimes" (2), "Usually" (3) or "Always" (4).

Immigrant Measures

Generational status. In this study, the generational status variable was created by the author, derived on the basis of the child's own nativity and that of her parents. Generational status is an indicator variable that equals one for a sample female that is described as first generation, two for second generation, and three for third generation. These subgroups can be defined as the following: foreign-born female with immigrant parents (first generation), U.S.-born female with immigrant parents (second generation), and a U.S.-born female with both U.S.-born parents (third generation).

The first two groups together make up the immigrant category consisting of females born to immigrant parents, whereas the third category consists of native-born children. The variable was derived from the following list of questions: Was the sample female's father type born in the United States? Was the sample female's mother type born in the United States? Was the sample female born in the United States? Response categories for each preceding variable were indicated by "Yes" (1) or "No" (0). The first generation category of the generational status variable was determined if the answer to all of the preceding questions were "No." The second generation category was determined if the answer to the child nativity status was "Yes" and both parents' nativity status was "No." Finally, the third generation category was determined if the answer to all three questions was "Yes," born in the United States.

Child nativity status. Another main factor of interest was the nativity status of the sample female, which was considered a proxy for immigrant status. The Generation variable was re-coded into a new variable by collapsing "First Generation" and "Second Generation" sample females into an "Immigrant" category "1", and the "Third Generation" status into a "Non-Immigrant" category, "0."

Acculturation. To assess the female's acculturation and that of her parents, the respondent recorded the total number of years that the mother, father, and sample female have resided in the United States.

Statistical Analysis

STATA 10 *svy* commands (STATA Corporation, College Station, Tex) were employed for data analysis by incorporating primary sampling units generated by NSCH complex survey design. Descriptive statistics were created to describe the population sample. Percentages, 95% confidence intervals, and p-values were gathered for receipt of the HPV vaccine, initiation (one or two doses) or completion (three or more doses), socio-demographics, access to care, and immigrant differentials. Chi-square tests were used for bivariate comparisons of all categorical variables, and t-tests/Analysis of Variance (ANOVA) for continuous variables. In order to measure the determinants of vaccination among the sample population, the data was regressed using a logit regression model. Logit regression was chosen because the dependent variable (s) analyzed are dichotomous: the female has either received one or more doses of an HPV vaccination or not; or completed an HPV vaccination series, or not. Furthermore, a logit regression can make use of multiple independent variables such as dummy and indicator variables.

Multivariate logistic regression analysis was performed where demographic and socioeconomic variables were considered in varied models. Such regression analyses were used to examine the probability that a female age 10-17 in the sample received an HPV vaccination and completed the series given various characteristics of the individual. Interactions were

computed to investigate whether the effects of HPV vaccination uptake and completion vary by health care utilization and race-ethnic/immigrant characteristics. For both uptake and completion outcome models, Model 1 includes provider recommendation and health care utilization measures, and Model 2 adds interactions between race-ethnicity and immigrant differentials.

RESULTS

Descriptive Statistics

Descriptive statistics for the study sample are presented in Table 1 (see Appendix A for Tables 1-5). Overall, 68% of the sample reported provider recommendation of the HPV vaccine to their adolescent daughters, 92% reported that their daughters had health care insurance, 96% of the sample had a usual source of care, and approximately 92% reported not needing extra help in coordinating the female's health care among various services or providers. About 70% of the sample female's parents completed more than a high school education.

The majority of the sample is white (79%), third generation non-immigrant (97%), and non-Hispanic (89%). Most respondents (60%) reported always having received the specific health information they needed in the past year from the sample female's health care providers.

HPV Vaccine Obtainment

Sample vaccination rates. Table 1 and 2 present a summary of key variables based upon HPV vaccination behaviors (see Appendix A). In order to verify that outcomes were indeed measuring separate constructs, chi-square analyses and t-tests were conducted, testing for possible group differences. One of the main objectives of this study was to investigate factors that predict HPV vaccine obtainment. For the purposes of the following analyses, receipt was defined as a participant having obtained at least one HPV shot. The majority of females age 10-17 in the study sample had not received an HPV vaccine. More specifically, 13,376 females had not received the vaccine (60.9% of the sample), while 3,410 female adolescents had (15.5% of

the sample). Of those who had obtained the vaccine, 771 females (about 31% of those who initiated) completed the series, receiving all three shots (see Table 2 in Appendix A). The majority of females who received the vaccine were recommended by their provider to do so (80.19%), while the majority of females that had not received any shots did not receive a provider recommendation (80.27%). Summaries of these vaccination rates are presented in Tables 1 and 2.

Continuous measures. Overall, females in the sample were approaching 14 years old on average (M=13.77, SD=2.30), and had visited a provider less than twice in the past year (M=1.55, SD=1.85). It was also found that the females in the sample had been living in the U.S. on average for 7.97 years (SD=4.32), their mothers 20.81 years (SD=12.10), and fathers 22.66 years (SD=12.25). Age and number of provider visits in the past year were deemed significantly associated with receipt of vaccination, as well as completion of the series ($p \leq .001$). As seen in Table 2, the sample females who initiated but did not complete the series were a bit younger than those who had completed the series (14.83 years versus 15.05 years). Measures of acculturation were not significantly associated with HPV vaccination behavior.

***Insurance status*.** Results indicated in Table 1 a significant association between insurance coverage and whether the sample female had received an HPV vaccination or not. For instance, 95% of the sample of females who did receive the vaccine was insured, versus the 91% coverage rate of those who did not receive the vaccine. Insurance coverage was not significantly associated with vaccine completion among this sample population, as apparent in Table 2.

***Parental education level*.** It was found that level of both mother and father education was significantly associated with the sample female's receipt of the HPV vaccination ($p \leq .001$), and initiation/completion measures ($p \leq .05$). For instance, a larger portion of those females who did

not receive the HPV vaccine had mothers and fathers that did not reach a high school education as compared to those who had received the vaccine (see Table 1 in Appendix A), and those who completed the vaccine series had a greater percentage of father's who completed a high school education than those who only initiated the series (26.39% versus 20.73%).

Provider recommendation. A statistically significant difference was observed in chi-square analysis between provider recommendation and receipt of the vaccine, however was not deemed significant in initiation versus completion measures. In Table 1, more than 80% of females who received the vaccine had a provider recommendation, whereas only 19.73% of those who had never received any HPV shots had been recommended by their provider to do so.

Number of provider visits. No association was found between the number of provider visits in the past year and receipt of HPV vaccination, but in initiation versus completion measures, a significant association existed in the results. Sample females who completed the HPV vaccine series visited their provider more often in the past year than those who only initiated but did not complete the three-dose vaccine series (2.16 versus 1.84 average visits).

Usual source of care. Table 1 and 2 results revealed that whether or not the sample female had a usual source of care was significantly associated with HPV vaccine receipt, but not associated with initiation or completion behavior. A mere 1% more females whose parental figure did report receipt of the vaccine had a usual source of care (97.77%) than those who did not receive the vaccine (96.07%).

Personal provider. The respondent was asked if there are one or more persons that they think of as the sample female's personal doctor or nurse, to which a significant association was found in both HPV vaccine receipt and initiation/completion measures. About 96% of females who had received the vaccine also had a close personal doctor or nurse, and a greater proportion

of those who did not receive the vaccine also did not have a personal provider (7.88%) than those who did receive the vaccine (4.49%).

***Care coordination*.** In the parental report of whether or not they could have used extra help arranging or coordinating the sample female's care among the different health care providers or services in the past 12 months, no significant association was found with either receipt or initiation/completion measures ($p>.05$).

***Frequency of needed information*.** Respondents reported how often they received the specific information they needed from the sample female's doctors and other health care providers in the past year, to which a significant association was found in both receipt of vaccination measures and that of initiation/completion. For example, a higher majority of parents who reported always receiving the information they needed had a higher majority of daughter's who both obtained and completed the vaccination than those who either did not receive vaccination or only initiated the vaccine.

***Generational status*.** A statistically significant difference was not observed between the sample female's generational status and either receipt of HPV vaccination or initiation/completion measures ($p>.05$). Seeing that the immigrant population in this sample was small overall (N=508; less than 3% of the total female sample), generational status measures include a limited sample size.

***Child nativity status*.** Results indicated that a statistically significant difference was not observed between the sample female's nativity status and either receipt of HPV vaccination or initiation/completion measures ($p>.05$).

***Acculturation*.** Acculturation measures were not found to be significantly associated with either receipt of HPV vaccination or initiation versus completion measures.

Generational Status

Table 3 presents a summary of key variables stratified by generational status (first, second, third) [see Appendix A]. One of the main objectives of this study was to investigate generational status and its association with HPV vaccination obtainment and completion. A summary of characteristics within the population allow for a greater understanding of disparities that exist among each generational level. Among first, second, and third generation females age 10-17; age, number of visits to provider in past years, provider recommendation of the HPV vaccine, insurance coverage, usual source of care, whether sample female has a close personal provider, level of care coordination assistance, frequency of receiving needed health care information, and race/ethnicity were all significantly strong correlates ($p \leq .001$) with generational status. Education level and acculturation of the sample female's mother and father was excluded from the model due to instability, and therefore could not be examined as a possible correlate.

Socio-demographic measures. Results indicated in Table 3 a significant association between insurance coverage and whether the sample female was first, second, or third generation. For instance, 93% of the sample of females who were third generation non-immigrants were insured, versus the 59.78% coverage rate for second generation immigrants and 70.83% coverage rate of those who were first generation immigrants.

A statistically significant difference was observed in chi-square analysis between provider recommendation and generational status. As seen in Table 3, only 18% of first generation females did receive a provider recommendation for the HPV vaccine, whereas 32% of those were native-born third generation females had been recommended by their provider to receive the vaccination. Relatedly, a significant association existed in the results for frequency of provider visits. Surprisingly, sample females who were identified as first generation immigrants

visited their provider more often in the past year than both second-generation immigrants and third-generation non-immigrant females (2.28 versus 1.37, 1.55 visits). Table 3 reveals that usual source of care was significantly associated with generational status of the female, as first generation immigrants fared worse than third generation non-immigrants in terms of having a usual source of care (72% versus 97%).

The respondent was asked if there are one or more persons they think of as the sample female's personal doctor or nurse, to which a significant association was found in with generational status. Just over half of first generation immigrant females had a close personal doctor or nurse (52%), compared to almost the entire sample of third generation non-immigrants (94%).

Not surprisingly, a majority of third generation female's parental figures reported always having receiving the information needed about the sample female's health in the past year (61%). Yet a surprising result exists in first generation females reporting a similar measure a 54.55%, with second-generation immigrants appearing the worst off in this category (22.62% never received the information they needed).

Over half of the sample of first and second-generation immigrants reported being of Hispanic ethnicity, whereas 90.51% of native-born third-generation females reported being non-Hispanic. Relatedly, the majority of second- and third-generation females were white, and the highest percentage of blacks resided in the first-generation immigrant category.

HPV Vaccine Behavior: Logistic Regression Analyses

Due to the large number of possible predictor variables proposed in this study, a multivariate regression combining the various characteristics of the sample female were tested,

all possible contributing variables taken into account in order to examine the impact that the study variables have on vaccination behaviors. Vaccination status (whether the sample female obtained at least one shot of the vaccine or not) and vaccination completion (whether the sample female completed the three dose series of the vaccination) were examined separately as dichotomous outcome variables.

To investigate which component variables were predictive of vaccination behavior, Model 1 regression analysis was conducted using the following predictor variables: provider recommendation, insurance coverage, usual source of care, personal provider, level of care coordination assistance, and frequency of needed health information. The remaining components (generational status, nativity, race/ethnicity) were then placed together into a final multiple regression model (Model 2) in order to determine which variables would still emerge as predictive of HPV vaccine behavior. Birthplace and child nativity status were each excluded from the models due to colinearity. Parental education level and acculturation were also excluded from analysis due to model instability, and therefore could not be examined as possible correlates. A summary of predictors can be seen in Table 4 and Table 5 (see Appendix A).

HPV Vaccination Obtainment

Among females age 10-17 in the chosen sample for Model 1, provider recommendation of the HPV vaccine, level of care coordination assistance, and report of always having obtained the needed health information were among the strongest correlates of vaccine obtainment. The logistic regression revealed that health care utilization measures including insurance coverage, usual source of care, and personal provider did not predict whether the sample female received the HPV vaccine or not.

As expected, having received a provider recommendation for the vaccine significantly increases vaccination coverage. The effect of recommendation remains significant across both models. An examination of the possible predictors revealed that as compared to females who did not receive a recommendation, those that were recommended by their provider to receive an HPV shot had a near 15 unit increase in log-odds of having obtained the HPV vaccine, 95% CI [13.34-16.30] (OR=14.75, $p \leq .001$).

Vaccination coverage also differs significantly by care coordination assistance and how often a parent reported receiving needed health information about the sample female within the last year. Results revealed that compared with the parental figures that reported needing help coordinating care of their daughters, the daughters of those who did not had greater odds of vaccination, 95% CI [1.002-1.42] (OR=1.194, $p \leq .05$). Relatedly, it was found that parental figures who reported always receiving the needed health information about the sample female compared to those who reported never receiving the information needed, had daughters with nearly one and a half greater odds of vaccination, 95% CI [1.037-1.797] (OR=1.365, $p \leq .05$).

The second model explores whether the relationship between HPV vaccine obtainment differences by race/ethnic group and generational status, given the addition of selected race/ethnicity characteristics and generational status to the logistic regression. Provider recommendation, frequency of needed information, and race measures were all significant predictors of HPV vaccination in this model. Compared to those who did not receive a provider recommendation for the HPV vaccine, those who had were nearly 15 times higher odds of receiving the vaccine, 95% CI [13.19-16.22] (OR=14.63, $p \leq .001$). Among parents who reported always having received the information they needed on the sample female's health status from a provider in the past year, their daughters had a near one and a half greater odds of receiving the

HPV vaccine as compared to those who never received the needed information, 95% CI [1.01-1.972] (OR=1.474, $p \leq .05$). It was found that black females age 10-17 had lower odds than white females to be vaccinated, 95% CI [0.691-0.973] (OR=0.820, $p \leq .05$). Meanwhile, compared to whites, multi-racial females had nearly one and a half greater odds of receiving the HPV vaccine, 95% CI [1.095-1676] (OR=1.395, $p \leq .05$). The effect is no longer significant for care coordination measures in this model. Similarly, the model shows that both Hispanic ethnicity and generational status was not a significant predictor of whether a sample female obtained the HPV vaccine.

HPV Vaccination Completion

A logistic regression was run in Table 5 to determine if scales assessing females' demographics and health care utilization were predictive of vaccine completion. In Model 1, provider recommendation and care coordination measures approached a borderline prediction of vaccine completion, but not a strong correlation at a 5% significance level. Race was the strongest correlate of vaccine completion. This model shows that the prediction of vaccine completion for blacks differs significantly from that of other race-ethnic groups (the interactions for other groups were not significant). The interaction shows that blacks had significantly lower odds of completing the vaccine as compared to whites, 95% CI [0.298-0.686] (OR=0.452, $p \leq .001$)

DISCUSSION

More than 40 strains of genital HPV account for the most common STI in the United States; two high-risk HPV types 16 and 18 alone account for 70% of cervical cancer lesions (CDC, 2013; Jemal et al., 2013; "Immunization," 2013). Two vaccines, Gardasil (FDA-approved in 2006) and Cervarix (approved in 2009) were launched to promote immunity for the most common strains of HPVs, and have since shown a combined 90% efficacy for five years in preventing persistent HPV infections and precancerous lesions from the targeted HPV types (CDC, 2013). The vaccine is accepted for females as young as 9 in order to increase rates of complete vaccination before one's first sexual encounter (Chou et al., 2011; CDC, 2012); the Advisory on Immunization Practices asks providers to recommend the vaccine to adolescents between age 11-12 for this reason (Chou et al., 2011). The CDC recognizes a yearly increase in vaccine coverage since 2006; however, the percentage of females who complete the HPV vaccine series is dropping over time, especially among high-risk adolescent females.

Foreign birthplace may explain several disparities in vaccination and has been identified in previous studies as a significant barrier to health care access (Goal et al., 2003; Hagan et al.,2003; Javier et al., 2010; Fortuny & Chaudry, 2009; Schulmeister & Lifsey, 1999; Maxwell et al., 2000). The cohort of children in the U.S. with at least one foreign-born parent represents the fastest growing group of American children (Fortuny & Chaudry, 2009). The immigrant population in the U.S. is rapidly increasing, and coupled with HPV prevalence, the literature to date reveals a growing importance of how vaccinations for this segment of the U.S. population differ from those of the majority native-born population (CDC, 2009; Ferlay et al., 2010; Grandahl, et al., 2012)

The purpose of this work was to estimate the association between HPV vaccine obtainment and initiation/completion rates among both U.S.-born and immigrant adolescent females as young as age 10-17, determine the extent to which all factors vary by generational status; and identify factors that predict vaccine uptake and adherence to the three-dose series among this sample. Identifying characteristics that describe the adolescent population who both obtain and complete the vaccine among U.S.-born and generationally differentiated female adolescents, are necessary to develop evidence-based strategies to improve completion rates among native-born and immigrant adolescents.

This study's findings were somewhat consistent with other studies that examined HPV vaccination uptake and completion among varying racial and ethnic groups. While many studies have examined the direct relationships between many of the factors used in this study and HPV vaccination behavior, the immigrant components have not been sufficiently researched to date, as to this author's knowledge, *no studies* have analyzed generational status as a factor in vaccination on a national scale.

Previous reports that immigrant children are less likely to have health insurance, a usual source of care, and a doctor's visit in the past year were limited in that they did not differentiate generations (Coughlin & Uhler, 2002; McPhee et al., 1997; Schulmeister & Lifsey, 1999; Juon et al., 1999; Javier et al., 2010). Related variables have received little attention or have not been measured adequately (immigrant, nativity measures), while effects of others have been inconsistent (race and vaccination completion). Another model component, physician recommendation, has repeatedly been found to be predictive of vaccine obtainment, but due to the large number of factors that can influence this relationship, additional barriers to HPV

vaccination must be investigated (racial identity, generational status, obtainment of needed health care information, care coordination).

Not surprisingly, this study found that the majority of females had not received the vaccine, with 60.9% of the sample reporting that they had never received the HPV vaccine, and 15.5% of the sample reporting they had received at least one shot. Studies conducted prior to the vaccine release reported that high percentages of young women believed they would obtain it, however, rates after the release have been lower than expected. The low vaccine initiation rate in our study may be partially explained by the fact that compared with national samples within more recent time periods, awareness of HPV and parental acceptability of vaccination may be lower, as the date (2007) is just one year after the HPV vaccination was approved.

The results found in the current study are in line with rates found in other studies that were conducted after the release of the vaccine. For example, recent data from the U.S. National Immunization Survey indicates that only 49% of 13-17 year-olds received one or more doses of the HPV vaccine, and 32% received all three recommended doses (Perkins et al., 2012). Another study showed that uptake among 11- to 17-year-old females in the U.S. was 14.2% for all three doses of the HPV vaccine, with 3.0% among 11- to 12-year-old girls, and 18.7% among 13- to 17-year-olds (Laz et al., 2012). From data examining immigrant, low-income mothers of adolescent females, only 27% of girls initiated the vaccine (Tsui et al.,2013). Reiter found similar results, in that vaccine completion was less common among daughters who had moved from their birth states (2014). As these rates demonstrate, vaccination rates after the release of the vaccine were lower than anticipated, and have stayed low, particularly among vulnerable populations of immigrants and adolescents.

The parental figure in this study was also asked to report the sample female's completion of the vaccine. Results indicated that of those who had obtained the vaccine, 771 females (about 31% of those who initiated) completed the series, receiving all three shots. These results coincide with results found in previous research. For instance, Perkins and colleagues found that of 41% of adolescent girls who initiated HPV vaccination, about half (20%) completed the series (2012). Reiter had similar findings (2014), and the Centers for Disease Control and Prevention reported that in 2009, only 44.3% of eligible adolescent females age 13-17 initiated the vaccine series, and only 26.7% completed the three-dose vaccination series (CDC, 2012). Rates reported from smaller studies on specific subgroup populations have varied widely but reflect suboptimal utilization (e.g., 26% to 47%), dependent on sample characteristics, recruitment methods, data collection timing (Chou at al., 2011; Cook et al., 2010; Rahman et al., 2014; Laz et al., 2012; Reiter, 2014; Schluterman et al., 2011; Perkins et al., 2012).

Discussion of Results by Hypotheses

Hypothesis 1: Provider recommendation will predict HPV vaccination, with higher levels of recommendation positively associated with vaccination. It was hypothesized that provider recommendation of the HPV vaccine would predict vaccination obtainment. When vaccine obtainment was investigated, recommendation was found to be predictive. While only 32% of the entire sample received a recommendation to obtain the HPV vaccine, results indicated that 80% of females who received the vaccine had a provider recommendation, whereas 80% of those who had never received any HPV shots had not received a recommendation from their provider to do so ($p \leq .001$). These results coincide with previous research, which found that physician recommendation was widely noted as a reason for

vaccination in their uniquely credible and persuasive nature on issues related to medical care (Perkins et al., 2012; Vadaparampil et al., 2013; Kobetz et al., 2011; Roland et al., 2014; Hirth et al., 2012; Marchand et al., 2013). Physicians play a large role in encouraging HPV vaccine uptake by adolescent females and in providing vaccine information to parents (Marchand et al., 2013). Messages from providers or other health care professionals that focus on helping parents who already plan to act in allowing HPV vaccine uptake for their daughters and reducing perceived barriers may be especially effective in increasing HPV vaccine behavior.

Additional research found that in a study of Latina/o parents of children age 11-17, the parents reported lack of strong provider recommendations as the main barriers to vaccine initiation (Warner et al., 2014). These findings demonstrate that failure of providers to discuss vaccination with their patients appears to be an important contributor to low rates of HPV vaccination (Perkins et al., 2012, Vadaparampil et al., 2013; Kobetz et al., 2011; Roland et al., 2014; Hirth et al., 2012; Marchand et al., 2013). When recommendation is not consistent, gaps result in care, especially in the following example for an immigrant population. More than half of the foreign-born parents in Colón-López's study had not received proper HPV vaccine orientation from healthcare provider (58.3 %), resulting in low HPV vaccination coverage (31.7 %) [2014].

While the initial correlations and regressions investigating recommendation and vaccine obtainment found a significant relationship, when initiation and completion were analyzed with recommendation, it was no longer found to be associated. The finding here, that provider recommendation is not significantly associated with initiation and completion of the vaccine, is a unique, unexpected result. As noted in the literature review section of this document, Reiter found that initiation and completion of HPV doses were more common among daughters whose

parents had received a provider recommendation (2014). Yet in the regression analyses, provider recommendation proved to be a strong predictor of female's vaccination decisions, as it maintained its predictive ability when all predictors of vaccine obtainment were placed into the final regression model for vaccine obtainment.

Hypothesis 2. Health care utilization measures will influence HPV vaccination; those sample females who have insurance, a usual source of care, a close personal provider, require less care coordination assistance, and obtain needed health care information more easily will have a higher likelihood of being vaccinated. It was theorized that health care utilization variables in this study would be associated with vaccine obtainment among the sample. All utilization variables were strongly associated with vaccine uptake, but did not all maintain a strong correlation with vaccine completion: only the existence of a personal provider and the frequency of one having obtained the health information needed for the female's care in the past year remained significant in bivariate associations of adherence. Of those females who received any number of vaccine doses, 95% were covered by insurance, 98% had a usual source of care, and 96% had a personal provider. Additionally, 92% of parents with females who did receive the vaccine reported not needing any help in coordinating their daughter's care among various providers and services, and 64% of those parents with vaccinated children reported always having received the health information they needed from their daughter's provider (s) in the past year. Those that completed the vaccine also visited the provider more often than those who only initiated the series (2.16 versus 1.84). These findings mimic similar research. For instance, Bednarczyk and colleagues found that not having insurance to help alleviate the cost of the vaccine (total of about $400) is a large barrier to vaccination (2011). Similarly, Reiter found that all vaccination outcomes were less common among daughters without health insurance

(2014), and Tsui and colleagues reported insurance status to be a strong predictor of vaccine initiation (2013). Additionally, mothers' vaccine acceptability in another study was deemed higher when the mothers insured (Barnack-Tavlaris et al., 2014).

In terms of provider visits, Perkins and colleagues (2012) found that those with greater access to medical care were more likely to have completed the HPV vaccine series and more overall visits to the doctor was associated with higher initiation and completion rates, as was seen in the current study as well. In the same study, girls who had more documented visits to the clinic were more likely to have completed two doses of the HPV vaccine as opposed those who had only completed one dose (Perkins et al., 2012).

These findings of health care utilization are especially important for immigrant populations, as in Grandahl's study of women immigrants' views on prevention of cervical cancer, women cited difficulties in contacting health care providers due to language problems, limited knowledge regarding the relation between sexual transmission of HPV and cervical cancer, and unfamiliarity with regular health check-ups (2012). Grandahl and colleagues' study also noted difficulty for immigrant females in communicating with health-care professionals, such as clearly explaining their symptoms and problems to their provider; a possible effect of low acculturation (2012). Similarly, the women expressed trouble understanding the letter of invitation from their health care provider and were unsure how to contact health-care facilities to make an appointment (Grandahl et al., 2012). Relatedly, Johnson et al. found that blacks viewed administrative processes as barriers to screening, whereas Asian immigrants held a variety of misconceptions concerning one's susceptibility to cancer, notably stigmas imposed by their community and providers (2008). In this way, it remains all the more important to increase ease of care coordination, encourage clear messaging between providers and patients, and make

access to health insurance and a usual source of care less wrought with barriers in order to increase HPV vaccination across various demographics.

Hypothesis 3. Being white, and a third generation non-immigrant will impact vaccination decisions, predicting higher frequency of HPV vaccination than those who identify as first or second-generation immigrants of black, Hispanic, multi-racial or other descent. It was anticipated that sample females who are white and non-immigrant of the third generation would have a higher level of vaccination than their immigrant, racially diverse counterparts. This hypothesis was not entirely supported, as generational status or being of Hispanic origin was not found to be a significant predictor of vaccination obtainment or completion in the sample. However, race was significantly associated with both vaccine obtainment and completion, and being a black female was identified as the strongest correlate of vaccine completion in that blacks were significantly less likely than whites to complete vaccination. As hypothesized, whites made up the majority of the population of those females who both initiated (81%) and completed vaccination (86%), and less than half of blacks that initiated vaccination completed the full series. Blacks were the second largest group to have never received the HPV shot next to whites (12%), and those females of multi-racial or other race were the least likely to both obtain the vaccine and complete the series.

A few results in this analysis parallel previous research. For instance, Goal and colleagues (2003) found that in a study of racial and ethnic subgroups comprised largely of immigrants, immigrants had lower screening rates for cervical, breast, and colorectal cancer than non-immigrants, mimicking the low HPV vaccination rates in this study. Available research on the uptake of HPV vaccination among immigrant female adolescents is rare, but the results in this study are hardly surprising given that the overall awareness of the HPV vaccine among

foreign-born women is lower than their native-born counterparts in the U.S. (Barnack-Tavlaris et al., 2014; Johnson et al., 2008). Additionally, low vaccine uptake was expected given that immigrant health, social, and behavioral characteristics differ substantially from their U.S.-born counterparts and contribute to vast barriers in care access (CDC, 2009; Grandahl et al., 2012). Lower rates of screening among foreign-born patients raise concerns that disparities in vaccine completion seen in this study could worsen existing disparities in cervical cancer.

Disparities have been demonstrated across race/ethnicity in several studies as well, supporting the findings revealed in the current study (Pruitt & Schootman, 2010; Marchand et al., 2013, Perkins et al., 2012, Chao et al., 2010, Velicer, Slezak, & Jacobsen, 2010). Available data indicates that race does not consistently predict uptake of the HPV vaccine series, but minorities have been found to be less likely than whites to complete the series in the U.S., as was revealed in the current study with black female adolescents age 10-17 (Perkins et al., 2012; Chou et al., 2011). In this way, some studies found evidence for ethnic differences in vaccine initiation, whereas others report no differences. Pruitt and Schootman (2010) showed that ethnic minority females were less likely to have received the HPV vaccine than whites, yet Chao and colleagues (2010) reported that Latina females were more likely to receive the vaccine compared to other ethnic groups. Additionally, Bednarczyk and colleagues (2011) found that black women were 33% less likely to have initiated HPV vaccination than whites, and in Schluerman's study (2011), blacks were less than half as likely as whites to complete the series in all age groups after adjustment for insurance and had 0.35 the odds of adherence, very similar to the 0.45 the odds of adherence in the current study as compared to whites. Such findings indicating lower rates of vaccination among minority and immigrant female adolescents, particularly black females, are

concerning given the higher risk of HPV-linked diseases, especially cervical cancer, among these populations (Lindley et al., 2013; Marchand et al., 2013).

Generational Status

Generational status was one of the novel variables investigated in this study. Surprisingly, generational status was not directly related to any of the outcomes, assessed via bivariate correlations and regressions in this study. While unexpected, the lack of support for this hypothesis is not entirely out of line with the research, as only one study linked closely health care utilization and generational status (Burgos et al., 2005). It is possible that low significance is due to the significantly small sample size of female immigrants age 10-17 in this study (N=585).

The findings indicate that the generational status of an adolescent female is not associated with or predictive of influencing she and her parents to get her vaccinated. In summary then, it appears that immigrant differentials and generational status are not necessarily strong predictors of vaccination. While little previous research in the area of HPV vaccinations has investigated these two variables, this study suggests that immigrant differentials are important to consider when trying to understand what factors may influence female adolescents' obtainment of the HPV vaccine, as generational status still had indirect influence on vaccination, to be explored.

The results from this study might seem to suggest that HPV vaccination is not related to one's nativity or generational status, and hence may lead to the erroneous conclusion that targeting immigrant populations will not have an effect on HPV vaccine outcomes. However, the results of the study clearly stow that generational status does have an impact on outcomes indirectly, through its relationships to health care access and utilization variables (see Table 3); thus research efforts in this area are still vital.

Categorizing 10- to 17-year-old females according to generational status revealed more marked disparities in the areas of access and utilization than in vaccination behavior, supported by one of the only existing studies that assesses the impact of generational status on health care utilization (Burgos et al., 2005). For instance, all health care utilization variables revealed a strong association with generational status in this study. Specifically, 29% of first generation immigrant females were without health insurance as compared to only 6.8% of third-generation non-immigrants.

Additionally, females in the first generation revealed the highest need of care coordination as compared to second- and third-generation females (33%); and immigrants were much less likely to have a personal provider, as 48% of first generation females did not have a personal provider as compared to 19% of second-generation immigrants and only 3% of third-generation non-immigrants. Burgos and colleagues found in their study of generational status relating to health care utilization for Mexican American children that more than two thirds were poor and uninsured, and had parents with low educational attainment (2005).

One revealing finding was that first-generation immigrant females reported more visits to the doctor than both second- and third-generation females (2.28 times versus 1.37 and 1.55). This finding was particularly surprising, as more first-generation Mexican American children had not seen a doctor in the past year as compared with second- or third-generation children in Burgos and colleagues' study (2005). The results described reveal that understanding the risk factors related to generational status is vital for providers, health care institutions, and policy makers alike who wish to increase vaccination uptake and close the existing disparate gap.

Hypothesis 4. Acculturation measures will influence HPV vaccination, with higher number of years in the U.S. positively associated with vaccination. Acculturation was

hypothesized to influence HPV vaccine obtainment and completion. Surprisingly, acculturation was not directly related to any of the outcomes, neither uptake nor initiation/completion, assessed through the bivariate correlations in this study. Lack of support for this hypothesis is unexpected, as previous research by Tiro and colleagues found that in a state-wide survey of Californians, young adult women living in the U.S. for less than five years were less likely to have initiated the vaccine series than women living in the U.S. for five or more years (2007).

Study Limitations

The results of this study are subject to some limitations that warrant discussion. This study only utilized data on vaccination status from a parent's or guardian's recall based on a telephone survey, and was not verified via medical records; therefore may overestimate or underestimate (parent not aware that daughter received the vaccine) vaccine uptake in this population. In this way, responses may also reflect recall bias. Thus, future research with similar populations should attempt to verify self-reports through medical records or a health provider.

While a substantial number of parent's and/or guardians participated in this nationally generalizable study, a larger sample size would have allowed for a better analysis of the impact of some of the study variables. More specifically, HPV vaccine behavior or immigrant differentials (e.g., vaccine initiation/completion, child nativity, generational status) may have reported greater strength of associations with a larger sample size. Since, for example, the sample of first generation females age 10-17 was so small (N=25), it is difficult to make solid inferences regarding the association between generational status and vaccine behavior.

Additionally, the sample for this study was largely white with excellent quality of reported health care access (e.g., health insurance, usual source of care). A more diverse sample may have been more representative of U.S. adolescent females in general. In other words, including a larger number of non-white participants could have expanded the sample, as the respondents represented in this study represented a narrow range of ethnicities. As a result, females who participated in the study are not be representative of all females age 10 to 17 in the United States. However, NSCH 2007 is one of the largest available collections of data on adolescent females in the U.S. and one of the only datasets that allows analysis of both HPV vaccination and generational status at this time. That being the case, the date of the data likely had no impact on the external validity of the study.

Another limitation of the current study concerns some of the study measures. Because this investigation included a generational status variable that had not been extensively tested in this area, the variable had to be created and modified. Thus, research in the area of HPV vaccines should continue to modify and evaluate the measures of immigrant differentials in order to confirm the findings found in this study.

A related idea that also needs to be considered when reviewing the findings from this research is the retrospective nature of the study, in that predictors were assessed just one year after Gardasil was approved, and two years prior to Cervarix's approval. It may be that the female adolescents who obtained the vaccine have exceptional access to educational resources/promotional materials of HPV, and the nature of the vaccine. Additionally, parents may likely be more comfortable vaccinating their younger daughters today than was reflected in this data from 2007. Future research should address this limitation by assessing HPV behavior in

more recent datasets, and then comparing the uptake of either Gardasil or Cervarix among key high-risk populations.

Another limitation was the potential for increased nonresponse from non-English, non-Spanish speakers in the sample. Not being able to identify which respondents used translators or the respondent's language proficiency, meant no possibility of adjusting for this variable. This nonresponse would likely bias the findings, thus underestimating the relationship between foreign-birth/generational status and HPV vaccination behavior.

Suggestions for Future Studies

One of the most important tasks for future research in this area is to focus on developing and validating scales to assess the generational status and immigrant components investigated in this study. While some variables were assessed with validated scales (initiation/completion), generational status was not, and this inability to use well-researched measures may have impacted the results of the current study. Therefore, researchers investigating HPV vaccination behavior among immigrant populations should focus on identifying variables that may have an impact on vaccine decisions, and determine the most effective means in which they should be measured.

Future research into factors specific to the immigrant population, such as the influence of limited English proficiency and disparate access to culturally proficient health care providers, would be valuable. Additionally, general factors that may prove to have unique effects on immigrants should be studied further, such as the effects of the gender/race or ethnicity of one's provider, amount of time spent with patients, and even type of health care provider. For instance,

Vadaparampil and colleagues' found that of providers who care for 10-17 year olds, pediatricians were most experienced with vaccine administration (2013). Yet obstetricians/gynecologists were more likely to administer vaccines to those who complete the vaccine series than pediatricians in Hirth and colleagues' study (2012). Thus, provider title and nature of their work may influence rates of vaccination and are deserving of future study, especially because providers may be reluctant to vaccinate young females if they are uncomfortable discussing issues related to sexuality and are concerned about native parental reactions, as was found in a study by Perkins and colleagues (2012).

Finally, future research in this area should also move away from the analysis of only direct relationships among variables and outcomes, and should begin to focus more on complex relationships. Because there were no previous national HPV studies investigating generational status to the author's knowledge, the tests in this study were exploratory. Additional research involving complex modeling is needed in this area, so that alternative relationships can be tested and compared.

Strengths of Study

This study has several important strengths. The use of a large, nationally representative sample of parents from high-risk subgroups, and a sampling scheme that allowed for comparison between racial and ethnic groups is notable. Additionally, the use of novel immigrant differentials providing unique differentiation of female adolescents age 10-17 according to generational status is a strong aspect of this study; the stratification of which is important to identify comparisons across first, second, and third generation female adolescents. Finally, the

study also offers early insights into the correlates of HPV vaccine behavior among immigrant differentials and is unique in being the first to address generational status in a racially and geographically diverse population at high-risk for HPV-related morbidities on a nationwide scale.

Conclusion

The results of this study have influential implications for future HPV vaccine research. In the context of the findings, it becomes important to design interventions to help overcome barriers and reduce concerns about limited knowledge and cost of the vaccine for populations most vulnerable. Strategies increasing cues to action, specifically recommendations from providers among immigrant populations, would likely prove beneficial given the strong associations between doctor recommendation and vaccine uptake in this study's sample.

In summary, HPV vaccination obtainment and completion that was proposed in this study was supported with a few modifications. These modifications were logical, and provide a deeper, and perhaps more interesting, understanding of the relationships between the components. While the results of the regression analyses seemed to suggest that certain model components are not related to HPV vaccine outcomes such as generational status, bivariate associations reveal that all components are important factors of HPV vaccine behavior. In this way, while not all components are directly related to vaccine outcomes, they do significantly impact other elements. Given the lack of any previously published research in the area of HPV vaccinations testing generational status on a national scale, this study provides an important starting place from which to investigate immigrant differentials and HPV vaccination decisions.

While results from subgroup analyses such as generational status should be viewed as tentative until confirmed by future research, the results presented here are important in offering new insight into determinants of HPV vaccine obtainment and completion. Furthermore, the findings from this study begin to confront disparities in helping to lower the number of young women affected by HPV-associated diseases in the United States. Immigrant and non-English-speaking women, for instance, may experience elevated risk for cervical cancer due in part to lack of access to Pap screening or pelvic exams in their home countries, and difficulties navigating the medical system in the U.S. Immigrant women may also be unfamiliar with guidelines and medical practices in the United States that can protect both themselves and their daughters against cervical cancer. Thus, interventions with culturally targeted messaging are needed to educate low income, immigrant, and ethnic minority mothers in order to enhance uptake of the vaccine among foreign-born populations in the U.S.

Since immigration, and certainly generational status, are fairly new in HPV vaccination research on the national level, the fact that vaccination uptake was not associated with these factors is a unique finding in the area of the research. Even though the strength of the relationship between nativity status (Immigrant vs. Non-Immigrant) and vaccine obtainment was small, it will still be interesting to investigate this construct further in future research. It may be that immigrant differentials are not as salient in smaller sample sizes, and that more complex experiments to investigate effects is needed. In the final analysis, nativity and generational status's impact on vaccination decisions is an important one to consider when experts look at ways to increase vaccinations, as immigrant mothers and daughters may have concerns as it relates to language and access barriers in the way of the vaccine. Immigration status will also be

an important variable to investigate in future STI vaccine studies, as more STI vaccines are currently in development.

Race, nativity, and ethnicity are widening the disparate gap in HPV vaccine rates worldwide. Additional targeted interventions are needed in order to improve not only vaccination obtainment, but also completion of the three-dose series, particularly among young adolescent immigrant populations. As our findings suggest, there exists a need for culturally appropriate interventions aimed at building physician interaction and recommendation, and addressing concerns about vaccination among those most vulnerable.

Examining populations with the highest frequency of missed HPV vaccine opportunities is paramount in the success of public health interventions aimed at increasing uptake to levels that mimic the Healthy 2020 goals of 80% vaccine coverage. Equally, identifying immigrant, adolescent female populations as a priority in HPV vaccine research—stratified further by generational status for more comprehensive study, unveils a vital opportunity to shrink the widening gap of vaccination in cross-cultural populations worldwide.

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APPENDIX A TABLES

TABLE 1. CHARACTERISTICS OF SAMPLE FEMALES AGES 10-17 BY HPV VACCINE RECEIPT

		Sample female had received at least one dose of HPV vaccine		
	Overall	Yes	No	P-value
Factor	n (%)[a]	n (%) [b]	n (%)[c]	*P*
N	21,975	3,410	13,376	
Age				≤.001§
Mean (SD)	13.77 (2.30)	14.86 (1.67)	14.61 (1.71)	
Number of visits to provider in past year				≤.001§
Mean (SD)	1.55 (1.85)	1.90 (1.86)	1.47 (1.84)	
Daughter years in U.S.				.285§
Mean (SD)	7.97 (4.32)	8.95 (4.68)	8.46 (4.36)	
Mother years in U.S.				.928§
Mean (SD)	20.81 (12.10)	22.24 (12.15)	22.17 (12.48)	
Father years in U.S.				.088§
Mean (SD)	22.66 (12.25)	24.85 (12.33)	23.30 (12.40)	
Provider recommendation				≤.001†
Yes	5,303 (31.81)	2,680 (80.19)	2,576 (19.73)	
No	11,366 (68.19)	662 (19.81)	10,47 (80.27)	
Insurance coverage				≤.001†
Yes	20,280 (92.18)	3,241 (95.16)	12,229 (91.58)	
No	1,721 (7.82)	165 (4.84)	1,124 (8.42)	
Usual source of care				≤.001†
Yes	21,184 (96.33)	3,331 (97.77)	12,826 (96.07)	
No	808 (3.67)	76 (2.23)	524 (3.93)	
Personal provider				≤.001†
Yes	20,405 (92.87)	3,251 (95.51)	12,282 (92.12)	
No	1,566 (7.13)	153 (4.49)	1,051 (7.88)	
Care coordination assistance needed				.547†
Yes	1,522 (8.24)	273 (8.46)	896 (8.13)	
No	16,956 (91.76)	2,954 (91.54)	10,126 (91.87)	
Frequency of needed health info in past year				≤.001†
Never	1,271 (5.97)	101 (3.00)	896 (6.95)	
Sometimes	1,982 (9.30)	286 (8.49)	1,236 (9.59)	
Usually	5,197 (24.40)	835 (24.78)	3,184 (24.70)	
Always	12,852 (60.33)	2,147 (63.73)	7,574 (58.76)	
Hispanic				.751†
Yes	2,376 (10.92)	340 (10.08)	1,357 (10.27)	
No	19,389 (89.08)	3,033 (89.92)	11,862 (89.73)	
Race				≤.001†
White only	16,506 (79.31)	2,640 (81.53)	10,094 (79.60)	

Black only	2,280 (10.96)	259 (8.00)	1,464 (11.54)	
Multi Racial	1,064 (5.11)	197 (6.08)	584 (4.61)	
Other only	961 (4.62)	142 (4.39)	539 (4.25)	
Generation				.212†
First	25 (0.11)	4 (0.12)	18 (0.14)	
Second	560 (2.57)	68 (2.01)	335 (2.53)	
Third	21,216 (97.32)	3,305 (97.87)	12,888 (97.33)	.079†
Child nativity status				
Immigrant	585 (2.68)	72 (2.13)	353 (2.67)	
Non-Immigrant	21,216 (97.32)	3,305 (97.87)	12,888 (97.33)	
Mother birthplace				.932†
Born in U.S.	18,015 (88.83)	2,840 (89.56)	11,041 (89.51)	
Not born in U.S.	2,266 (11.17)	331 (10.44)	1,294 (10.49)	
Father birthplace				.809†
Born in U.S.	15,199 (90.01)	2,338 (90.69)	9,317 (90.84)	
Not born in U.S.	1,686 (9.99)	240 (9.31)	939 (9.16)	
Child birthplace				.581†
Born in U.S.	20,977 (96.25)	3,258 (96.48)	12,744 (96.28)	
Not born in U.S.	818 (3.75)	119 (3.52)	493 (3.72)	
Highest level of father's education				≤.001†
Less than HS	1,295 (7.71)	150 (5.85)	802 (7.86)	
HS graduate	4,001 (23.83)	569 (22.20)	2,448 (24.00)	
More than HS	11,494 (68.46)	1,844 (71.95)	6,950 (68.14)	
Highest level of mother's education				≤.001†
Less than HS	1,560 (7.72)	209 (6.61)	949 (7.72)	
HS graduate	4,394 (21.75)	596 (18.86)	2,764 (22.49)	
More than HS	14,249 (70.53)	2,355 (74.53)	8,577 (69.79)	

Notes: The sample female was classified as having obtained the vaccine if parent reported their receiving any number of shots. Abbreviations: HPV, human papillomavirus; HS, high school

a Numbers do not add up to 21,975 due to missing data.

b Numbers do not add up to 3,410 due to missing data

c Numbers do not add up to 13,376 due to missing data

§ T-test

† Pearson's x^2 test

TABLE 2. SUMMARY OF HPV VACCINATION BEHAVIOR AMONG SAMPLE FEMALES AGES 10-17

	Overall	Initiated (≥1 Dose)	Completed (≥3 Doses)	P-value
Factor	n (%)[a]	n (%)[b]	n (%)[c]	*P*
N	21, 975	2,490	771	
Age				≤.001§
Mean (SD)	13.77 (2.30)	14.83 (1.66)	15.05 (1.66)	
Number of visits to provider in past year				≤.001§
Mean (SD)	1.55 (1.85)	1.84 (1.66)	2.16 (2.44)	
Daughter years in U.S.				.515§
Mean (SD)	7.97 (4.32)	9.55 (4.42)	8.76 (5.20)	
Mother years in U.S.				.678§
Mean (SD)	20.81 (12.10)	22.60 (12.26)	23.37 (11.63)	
Father years in U.S.				.431§
Mean (SD)	22.66 (12.25)	24.90 (12.53)	26.61 (12.15)	
Provider recommendation				.096†
Yes	5,303 (31.81)	2,010 (81.61)	602 (78.90)	
No	11,366 (68.19)	453 (18.39)	161 (21.10)	
Insurance coverage				.802†
Yes	20,280 (92.18)	2,371 (95.37)	737 (95.59)	
No	1,721 (7.82)	115 (4.63)	34 (4.41)	
Usual source of care				.931†
Yes	21,184 (96.33)	2,444 (98.23)	757 (98.18)	
No	808 (3.67)	44 (1.77)	14 (1.82)	
Personal provider				.041†
Yes	20,405 (92.87)	2,374 (95.46)	747 (97.14)	
No	1,566 (7.13)	113 (4.54)	22 (2.86)	
Care coordination assistance needed				
Yes	1,522 (8.24)	189 (7.99)	66 (8.94)	.409†
No	16,956 (91.76)	2,177 (92.01)	672 (91.06)	
Frequency of needed health info in past year				.022†
Never	1,271 (5.97)	76 (3.08)	16 (2.10)	
Sometimes	1,982 (9.30)	221 (8.96)	45 (5.91)	
Usually	5,197 (24.40)	612 (24.82)	197 (25.85)	
Always	12,852 (60.33)	1,557 (63.14)	504 (66.14)	
Hispanic				.097†
Yes	2,376 (10.92)	242 (9.83)	60 (7.83)	
No	19,389 (89.08)	2,219 (90.17)	706 (92.17)	
Race				≤.001†
White only	16,506 (79.31)	1,912 (80.74)	634 (86.14)	
Black only	2,280 (10.96)	203 (8.57)	31 (4.21)	
Multi Racial	1,064 (5.11)	144 (6.08)	46 (6.25)	
Other only	961 (4.62)	109 (4.60)	25 (3.40)	
Generation				.223†
First	25 (0.11)	3 (0.12)	1 (0.13)	

Second	560 (2.57)	49 (1.99)	8 (1.04)	
Third	21,216 (97.32)	2,413 (97.89)	757 (98.83)	
Child nativity status				.097†
Immigrant	585 (2.68)	52 (2.11)	9 (1.17)	
Non-Immigrant	21,216 (97.32)	2,413 (97.89)	757 (98.83)	
Mother birthplace				.040†
Born in U.S.	18,015 (88.83)	2,084 (89.87)	671 (92.42)	
Not born in U.S.	2,266 (11.17)	235 (10.13)	55 (7.58)	
Father birthplace				.297†
Born in U.S.	15,199 (90.01)	1,706 (90.94)	553 (92.32)	
Not born in U.S.	1,686 (9.99)	170 (9.06)	46 (7.68)	
Child birthplace				.053†
Born in U.S.	20, 977 (96.25)	2,375 (96.35)	749 (97.78)	
Not born in U.S.	818 (3.75)	90 (3.65)	17 (2.22)	
Highest level of father's education				.011†
Less than HS	1,295 (7.71)	104 (5.57)	26 (4.37)	
HS graduate	4,001 (23.83)	387 (20.73)	157 (26.39)	
More than HS	11,494 (68.46)	1,376 (73.70)	412 (69.24)	
Highest level of mother's education				.045†
Less than HS	1,560 (7.72)	145 (6.27)	34 (4.70)	
HS graduate	4,394 (21.75)	408 (17.65)	153 (21.13)	
More than HS	14,249 (70.53)	1,759 (76.08)	537 (74.17)	

***Notes**:* The sample female was classified as having initiated the vaccine if parent reported their receiving only 1 or 2 shots, and completed as 3 or more shots. Abbreviations: HPV, human papillomavirus; HS, high school

a Numbers do not add up to 21,975 due to missing data.

b Numbers do not add up to 2,490 due to missing data

c Numbers do not add up to 771 due to missing data

§ T-test

† Pearson's x^2 test

TABLE 3. CHARACTERISTICS AMONG FEMALES AGE 10-17 BY GENERATIONAL STATUS

	Generational Status, n (%)			
Factor	First n=25[a]	Second, n=560[b]	Third, n=21,216[c]	*P*
Age				0.051δ
Mean (SD)	14.76 (1.90)	13.66 (2.23)	13.77 (2.30)	
Number of visits to provider in past year				0.010δ
Mean (SD)	2.28 (3.97)	1.37 (1.36)	1.55 (1.86)	
Daughter years in U.S.				≤.001δ
Mean (SD)	3.96 (3.82)	7.21 (3.94)	10.17 (4.33)	
Provider recommendation				≤.001†
Yes	4 (18.18)	78 (18.75)	5,172 (32.20)	
No	18 (81.82)	338 (81.25)	10,891 (67.80)	
Insurance coverage				≤.001†
Yes	17 (70.83)	333 (59.78)	19,725 (93.12)	
No	7 (29.17)	224 (40.22)	1,457 (6.88)	
Usual source of care				≤.001†
Yes	18 (72.00)	452 (81.44)	20,495 (96.79)	
No	7 (28.00)	103 (18.56)	680 (3.21)	
Personal provider				≤.001†
Yes	13 (52.00)	403 (72.22)	19,775 (93.50)	
No	12 (48.00)	155 (27.78)	1,374 (6.50)	
Care coordination assistance needed				≤.001†
Yes	5 (33.33)	105 (30.70)	1,400 (7.81)	
No	10 (66.67)	237 (69.30)	16,531 (92.19)	
Frequency of needed health info in past year				≤.001†
Never	3 (13.64)	107 (22.62)	1,146 (5.57)	
Sometimes	1 (4.55)	88 (18.60)	1,863 (9.05)	
Usually	6 (27.27)	93 (19.66)	5,049 (24.53)	
Always	12 (54.55)	185 (39.11)	12,525 (60.85)	
Hispanic				≤.001†
Yes	13 (52.00)	350 (62.61)	2,008 (9.49)	
No	12 (48.00)	209 (37.39)	19,157 (90.51)	
Race				≤.001†
White only	8 (47.06)	225 (59.37)	16,270 (79.72)	
Black only	6 (35.29)	50 (13.19)	2,221 (10.88)	
Multi Racial	0 (0.00)	11 (2.90)	1,053 (5.16)	
Other only	3 (17.65)	93 (24.54)	864 (4.23)	

Notes: Abbreviations: HPV, human papillomavirus

a Numbers do not add up to 25 due to missing data.

b Numbers do not add up to 560 due to missing data

c Numbers do not add up to 21,216 due to missing data

δ Analysis of Variance (ANOVA) test

† Pearson's x^2 test

TABLE 4. LOGISTIC REGRESSION RESULTS: PREDICTORS OF HPV VACCINATION OBTAINMENT AMONG FEMALES AGES 10-17

	Model 1			Model 2		
	OR	95% CI	S.E.	OR	95% CI	S.E.
Provider recommendation						
Yes (Ref: No recommendation)	14.75***	13.34-16.30	0.76	14.63***	13.19-16.22	0.77
Insurance coverage						
Yes (Ref: No coverage)	0.956	0.764-1.196	0.11	0.950	0.750-1.202	0.11
Usual source of care						
Yes (Ref: No usual source)	1.091	0.778-1.529	0.19	1.084	0.757-1.552	0.20
Personal provider						
Yes (Ref: No personal provider)	0.997	0.785-1.265	0.12	0.992	0.774-1.271	0.13
Care coordination assistance needed						
Yes (Ref: No assistance needed)	1.194*	1.002-1.422	0.11	1.164	0.967-1.401	0.11
Frequency of needed health info. in past year						
Sometimes (Ref: Never)	1.334	0.979-1.818	0.21	1.423*	1.026-1.973	0.24
Usually	1.284	0.968-1.704	0.19	1.403*	1.040-1.892	0.21
Always	1.365*	1.037-1.797	0.19	1.474*	1.101-1.973	0.22
Hispanic						
Yes (Ref: Not Hispanic)				1.068	0.875-1.303	0.11
Race						
Black only (Ref: White only)				0.820*	0.691-0.973	0.07
Multi Racial				1.355*	1.095-1.676	0.15
Other only				1.192	0.930-1.528	0.15
Generation						
Second (Ref: First generation)				0.764	0.104-5.620	0.78
Third				0.646	0.092-4.552	0.64

Notes: Probability of whether female obtained at least one shot of the vaccine modeled

Abbreviations: CI, confidence interval; HPV, human papillomavirus; OR, odds ratio; SE, standard error; Ref, reference group

* $p \leq .05$

** $p \leq .01$

*** $p \leq .001$

TABLE 5. LOGISTIC REGRESSION RESULTS: PREDICTORS OF SERIES COMPLETION OF HPV VACCINATION AMONG FEMALES AGES 10-17

	Model 1			Model 2		
	OR	95% CI	S.E.	OR	95% CI	S.E.
Demographics						
Provider recommendation						
Yes (Ref: No recommendation)	0.826	0.670-1.018	0.09	0.858	0.690-1.064	0.10
Insurance coverage						
Yes (Ref: No coverage)	0.909	0.597-1.387	0.20	0.925	0.592-1.444	0.21
Usual source of care						
Yes (Ref: No usual source)	0.862	0.442-1.679	0.29	0.877	0.425-1.810	0.32
Personal provider						
Yes (Ref: No personal provider)	1.161	0.716-1.882	0.29	1.066	0.652-1.745	0.27
Care coordination assistance needed						
Yes (Ref: No assistance needed)	1.321	0.968-1.802	0.21	1.315	0.941-1.838	0.22
Frequency of needed health info. in past year						
Sometimes (Ref: Never)	0.936	0.478-1.832	0.32	1.019	0.496-2.095	0.37
Usually	1.538	0.834-2.833	0.48	1.511	0.782-2.916	0.51
Always	1.577	0.865-2.875	0.48	1.518	0.794-2.902	0.50
Hispanic						
Yes (Ref: Not Hispanic)				0.796	0.541-1.171	0.16
Race						
Black only (Ref: White only)				0.452***	0.298-0.686	0.10
Multi Racial				0.940	0.652-1.354	0.18
Other only				0.753	0.469-1.209	0.18
Generation						
Second (Ref: First generation)				0.187	0.010-3.631	0.28
Third				0.313	0.019-5.233	0.45

Notes: Probability of whether female completed all three doses of the vaccine in series modeled
Abbreviations: CI, confidence interval; HPV, human papillomavirus; OR, odds ratio; SE, standard error; Ref, reference group
* $p \leq .05$
** $p \leq .01$
*** $p \leq .001$

APPENDIX B STATA CODE FOR DATA ANALYSIS

```
* data preparation *
use "V:\Desktop\nsch_2007_puf.dta", clear

* cleaning data *
rename sex gender
tab gender
rename AGEYR_CHILD Age
tab Age
rename K4Q20 TimesToDoc
tab TimesToDoc
rename K5Q43 GetInfoNeeded
tab GetInfoNeeded
rename EDUC_MOMR MomEducation
tab MomEducation
rename EDUC_DADR DadEducation
tab DadEducation
rename K11Q30 MomGeneration
tab MomGeneration
rename K11Q31 DadGeneration
tab DadGeneration
rename K11Q33 ChildGeneration
tab ChildGeneration
rename K11Q37A ChildTimeUS
tab ChildTimeUS
rename K11Q34A MotherTimeUS
tab MotherTimeUS
rename K11Q35A FatherTimeUS
tab FatherTimeUS

* label gender categories *
tab gender
label define gender 1 "male" 2 "female"
label values gender gender
tab gender

* narrowing data to females age 10-17 *
drop if gender == 1
tab gender
keep if Age >= 10
tab Age

* accounting for missing data *
replace gender=. if gender==6 | gender==7
tab gender
replace TimesToDoc=. if TimesToDoc==996 | TimesToDoc==997
tab TimesToDoc
```

```
replace GetInfoNeeded=. if GetInfoNeeded==6 | GetInfoNeeded==7
tab GetInfoNeeded
replace hispanic=. if hispanic==6 | hispanic==7
tab hispanic
replace MomEducation=. if MomEducation==6 | MomEducation==7
tab MomEducation
replace DadEducation=. if DadEducation==6 | DadEducation==7
tab DadEducation
replace MomGeneration=. if MomGeneration==6 | MomGeneration==7
tab MomGeneration
replace DadGeneration=. if DadGeneration==6 | DadGeneration==7
tab DadGeneration
replace ChildGeneration=. if ChildGeneration==6 | ChildGeneration==7
tab ChildGeneration
replace ChildTimeUS=. if ChildTimeUS==996 | ChildTimeUS==997
tab ChildTimeUS
replace MotherTimeUS=. if MotherTimeUS==996 | MotherTimeUS==997
tab MotherTimeUS

replace FatherTimeUS=. if FatherTimeUS==996 | FatherTimeUS==997
tab FatherTimeUS

* cleaning Hispanic variable *
label define hispanic 1 "yes" 0 "no"
label values hispanic hispanic
tab hispanic

* cleaning race variable *
label define racer 1 "White only" 2 "Black only" 3 "Multi Racial" 4 "Other only"
label values racer racer racer racer
tab racer

* cleaning mother education variable *
label define MomEducation 1 "Less than high school" 2 "12 years, high school graduate"   3 "More than
high school"
label values MomEducation MomEducation MomEducation
tab MomEducation

* cleaning father education variable *
label define DadEducation 1 "Less than high school" 2 "12 years, high school graduate" 3 "More than
high school"
label values DadEducation DadEducation DadEducation
tab DadEducation

* cleaning mother generation variable *
tab MomGeneration
label define MomGeneration 1 "yes" 0 "no"
label values MomGeneration MomGeneration
tab MomGeneration

* cleaning father generation variable *
```

```
tab DadGeneration
label define DadGeneration 1 "yes" 0 "no"
label values DadGeneration DadGeneration
tab DadGeneration

* cleaning child generation variable *
tab ChildGeneration
label define ChildGeneration 1 "yes" 0 "no"
label values ChildGeneration ChildGeneration
tab ChildGeneration

* generating HPVShot variable *
gen HPVShot= .
replace HPVShot=1 if K2Q83==1 | K2Q83==3
replace HPVShot=0 if K2Q83==2
tab HPVShot

label define HPVShot 1 "yes" 0 "no"
label values HPVShot HPVShot
tab HPVShot

* dichotimizing initiated/completed variable for ease of interpretation *
gen Frequency= .
replace Frequency=1 if K2Q84==3 | K2Q84==4
replace Frequency=0 if K2Q84==1 | K2Q84==2
tab Frequency

tab Frequency
label define Frequency 1 "completed" 0 "initiated"
label values Frequency Frequency
tab Frequency

* generating provider recommendation variable *
gen Recommend= .
replace Recommend=1 if K2Q85==1
replace Recommend=0 if K2Q85==2 | K2Q85==3
tab Recommend

tab Recommend
label define Recommend 1 "yes" 0 "no"
label values Recommend Recommend
tab Recommend

* generating insurance coverage variable *
gen Insured= .
replace Insured=1 if K3Q01==1
replace Insured=0 if K3Q01==0
tab Insured

tab Insured
label define Insured 1 "yes" 0 "no"
```

```
label values Insured Insured
tab Insured

* generating usual source of care variable *
gen UsualSource= .
replace UsualSource=1 if K4Q01==1 | K4Q01==3
replace UsualSource=0 if K4Q01==2
tab UsualSource

tab UsualSource
label define UsualSource 1 "yes" 0 "no"
label values UsualSource UsualSource
tab UsualSource

* generating personal provider variable *
gen CloseDoc= .
replace CloseDoc=1 if K4Q04==1 | K4Q04==2
replace CloseDoc=0 if K4Q04==3
tab CloseDoc

tab CloseDoc
label define CloseDoc 1 "yes" 0 "no"
label values CloseDoc CloseDoc
tab CloseDoc

* generating care coordination variable *
gen ExtraCareHelp= .
replace ExtraCareHelp=1 if K5Q21==1
replace ExtraCareHelp=0 if K5Q21==0
tab ExtraCareHelp

tab ExtraCareHelp
label define ExtraCareHelp 1 "yes" 0 "no"
label values ExtraCareHelp ExtraCareHelp
tab ExtraCareHelp

* generating frequency of needed info variable *
tab GetInfoNeeded
label define GetInfoNeeded 1 "Never" 2 "Sometimes" 3 "Usually" 4 "Always"
label values GetInfoNeeded GetInfoNeeded GetInfoNeeded GetInfoNeeded
tab GetInfoNeeded

* generating generation variable *
gen Generation= .
replace Generation=1 if ChildGeneration==0 | DadGeneration==0 | MomGeneration==0
replace Generation=2 if ChildGeneration==1 | DadGeneration==0 | MomGeneration==0
replace Generation=3 if ChildGeneration==1 | DadGeneration==1 | MomGeneration==1
tab Generation

label define Generation 1 "First" 2 "Second" 3 "Third"
label values Generation Generation Generation
```

```
tab Generation

* generating nativity variable *
gen Nativity= .
replace Nativity=1 if Generation==1 | Generation==2
replace Nativity=0 if Generation==3
tab Nativity

label define Nativity 1 "Immigrant" 0 "Non-Immigrant"
label values Nativity Nativity Nativity
tab Nativity


* sample descriptive stats *
tab gender
tab HPVShot
tab Frequency
tab Recommend
tab Insured
tab UsualSource
tab CloseDoc
tab ExtraCareHelp
tab GetInfoNeeded
tab hispanic
tab racer
tab Generation
tab Nativity
tab MomGeneration
tab DadGeneration
tab ChildGeneration
tab MomEducation
tab DadEducation

* generating sums *
sum Age
sum TimesToDoc
sum ChildTimeUS
sum MotherTimeUS
sum FatherTimeUS

* running t-tests to see difference in means based on HPVShot *
ttest Age, by (HPVShot)
ttest TimesToDoc, by (HPVShot)
ttest ChildTimeUS, by (HPVShot)
ttest MotherTimeUS, by (HPVShot)
ttest FatherTimeUS, by (HPVShot)

* running t-tests to see difference in means based on Frequency *
ttest Age, by (Frequency)
ttest TimesToDoc, by (Frequency)
ttest ChildTimeUS, by (Frequency)
```

```
ttest MotherTimeUS, by (Frequency)
ttest FatherTimeUS, by (Frequency)

* running ANOVA to see differences in means by generational status *
anova Age Generation
tab Generation, summarize(Age)

anova TimesToDoc Generation
tab Generation, summarize(TimesToDoc)

anova ChildTimeUS Generation
tab Generation, summarize(ChildTimeUS)

* running chi-square tests to determine associations by HPVShot */
tab Recommend HPVShot, cchi2 chi2 col
tab Insured HPVShot, cchi2 chi2 col
tab UsualSource HPVShot, cchi2 chi2 col
tab CloseDoc HPVShot, cchi2 chi2 col
tab ExtraCareHelp HPVShot, cchi2 chi2 col
tab GetInfoNeeded HPVShot, cchi2 chi2 col
tab hispanic HPVShot, cchi2 chi2 col
tab racer HPVShot, cchi2 chi2 col
tab Generation HPVShot, cchi2 chi2 col
tab Nativity HPVShot, cchi2 chi2 col
tab MomGeneration HPVShot, cchi2 chi2 col
tab DadGeneration HPVShot, cchi2 chi2 col
tab ChildGeneration HPVShot, cchi2 chi2 col
tab MomEducation HPVShot, cchi2 chi2 col
tab DadEducation HPVShot, cchi2 chi2 col

* running chi-square tests to determine associations by Frequency */
tab Recommend Frequency, cchi2 chi2 col
tab Insured Frequency, cchi2 chi2 col
tab UsualSource Frequency, cchi2 chi2 col
tab CloseDoc Frequency, cchi2 chi2 col
tab ExtraCareHelp Frequency, cchi2 chi2 col
tab GetInfoNeeded Frequency, cchi2 chi2 col
tab hispanic Frequency, cchi2 chi2 col
tab racer Frequency, cchi2 chi2 col
tab Generation Frequency, cchi2 chi2 col
tab Nativity Frequency, cchi2 chi2 col
tab MomGeneration Frequency, cchi2 chi2 col
tab DadGeneration Frequency, cchi2 chi2 col
tab ChildGeneration Frequency, cchi2 chi2 col
tab MomEducation Frequency, cchi2 chi2 col
tab DadEducation Frequency, cchi2 chi2 col

* running chi-square tests to determine associations by generational status */
tab Recommend Generation, cchi2 chi col
tab Insured Generation, cchi2 chi2 col
tab UsualSource Generation, cchi2 chi2 col
```

```
tab CloseDoc Generation, cchi2 chi2 col
tab ExtraCareHelp Generation, cchi2 chi2 col
tab GetInfoNeeded Generation, cchi2 chi2 col
tab hispanic Generation, cchi2 chi2 col
tab racer Generation, cchi2 chi2 col

** multivariable logistic regressions **
* HPVShot Model 1 *
logistic HPVShot i.Recommend i.Insured i.UsualSource i.CloseDoc i.ExtraCareHelp i.GetInfoNeeded

* HPVShot Model 2 *
logistic HPVShot i.Recommend i.Insured i.UsualSource i.CloseDoc i.ExtraCareHelp i.GetInfoNeeded
i.hispanic i.racer i.Generation

* Frequency Model 1 *
logistic Frequency i.Recommend i.Insured i.UsualSource i.CloseDoc i.ExtraCareHelp i.GetInfoNeeded

* Frequency Model 2 *
logistic Frequency i.Recommend i.Insured i.UsualSource i.CloseDoc i.ExtraCareHelp i.GetInfoNeeded
i.hispanic i.racer i.Generation
```

ACADEMIC VITA

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EDUCATION

The Pennsylvania State University, University Park, PA
Bachelor of Science in Health Policy and Administration
Bachelor of Arts in Advertising/Public Relations- Public Relations Option
Schreyer Honors College- Honors in Health Policy and Administration
Dean's List: 9/9 Semesters

HONORS AND AWARDS

Nancy Colfelt Scholarship, 2015
PHEAA Ready to Succeed Scholarship (RTSS), 2015
Aetna, Inc. Summer Scholar Award, 2014
James Wiggins and Christine Fleming Honors Scholarship, 2014 and 2015
Schreyer Merit Scholarship, 2014
The Frederick and Jeanne Riebel Lord Academic Excellence Scholarship, 2013-2015
Kappa Tau Alpha National Honor Society, 2013-2015
Order of Omega Greek Leadership Honor Society Nominee, 2014
The Honor Society of Phi Kappa Phi Nominee, 2013-2015
Golden Key International Honour Society Nominee, 2012 and 2013

ASSOCIATION MEMBERSHIPS/ACTIVITIES

Educator/Team Manager- Sexual Health Initiative, *HealthWorks* Peer Education, Fall 2013-2015
Student HIV Interventionist, *HealthWorks* Peer Education, Fall 2014-2015
Active Member, Phi Gamma Nu Professional Business Fraternity, Fall 2011-2015
University Relations Chair, Phi Gamma Nu Professional Business Fraternity, Fall 2013
Social Chair, Phi Gamma Nu Professional Business Fraternity, Fall 2013
Pledge Class Fundraising Chair, Phi Gamma Nu Professional Business Fraternity, Fall 2011
Collegiate Volunteer, Penn State Habitat for Humanity Spring Break Challenge, Spring 2013
Welcome Week Captain, Penn State Residence Life, Fall 2012