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Insurance Coverage and Completion of Human Papillomavirus Vaccine Series Among Hispanic Girls

Adrienne A. Scott
Walden University

Walden University

College of Health Sciences

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Adrienne A. Scott

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Review Committee
Dr. Maria Rangel, Committee Chairperson, Public Health Faculty
Dr. Cynthia Newell, Committee Member, Public Health Faculty
Dr. Susan Nyanzi, University Reviewer, Public Health Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
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Abstract

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MSc, New York Medical College, 2013

Dissertation Submitted in Partial Fulfillment

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Abstract

Human papillomavirus (HPV) is the most common sexually transmitted infection and the leading cause of cervical cancer in the United States. Women from racial and ethnic minorities with genital HPV are 2 to 3 times more likely to develop cervical cancer. Vaccines are currently available to prevent HPV infections; however, despite their effectiveness, national completion rates for these vaccines remain low among Hispanic adolescents compared to non-Hispanic White adolescents. The reasons for this racial/ethnic disparity are not fully understood. In this quantitative, cross-sectional study, which was guided by the socioecological framework, the extent to which insurance coverage and having a source of health care influenced completion of the HPV vaccine series among Hispanic adolescent girls was examined. Nationally representative data from the 2016 National Immunization Survey-Teen was analyzed. Results of multiple logistic regression showed that gaps in insurance coverage did not adversely affect completing the HPV vaccine series. Hispanic girls with continuous health insurance coverage ($p < .001$) and girls who experienced gaps in health insurance coverage ($p < .001$) were significantly more likely to complete the HPV vaccine series compared to Hispanic girls who were uninsured. These results can be used to guide effective strategies to increase HPV vaccination among Hispanic adolescents. Increasing the HPV vaccine series completion rate among Hispanic adolescents has important implications for positive social change, including decreasing their risk of infections, reducing the prevalence of cervical cancers later in life, and decreasing the economic burden associated with HPV infections among Hispanic women.

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Dedication

I dedicate this dissertation to my mother, Luceva V. McKoy, and sister, Janet C. Scott. You are always loved, never forgotten, and missed beyond measure. Your lives were a blessing. Thank you for your part in my scholastic journey.

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All praise and thanks to the Lord God Almighty, with whom any thing is possible. It is by His grace that I completed this study/doctoral program.

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Chapter 1: Introduction to the Study

Introduction

In the United States, genital human papillomavirus (HPV) is the most common sexually transmitted infection (STI) affecting men and women (Centers for Disease Control and Prevention [CDC], 2017). The infection is so common that individuals who are sexually active have a 75% chance of being infected with HPV at some point in their lifetimes (CDC, 2017; Tota, Chevarie-Davis, Richardson, DeVries, & Franco, 2011; Valentino & Poronsky, 2016). In the United States alone, approximately 80 million people are infected with HPV, and each year, 14 million newly infected cases are diagnosed, with 50% of the cases occurring in persons 15 to 24 years of age (CDC, 2017; Tota et al., 2011; Valentino & Poronsky, 2016).

In most cases, the infection is cleared within 2 years by the body's immune system, but persistent infection with high-risk HPV serotypes (e.g., HPV 16 and 18) can lead to cervical, anal, penile, vaginal, vulvar, and oropharyngeal cancers later in life (CDC, 2017; Nickel et al., 2017; Pahud & Ault, 2015). Likewise, persistent infection with low-risk serotypes (e.g., HPV 6 and 11) can lead to the development of genital warts in adolescents (CDC, 2017; Nickel et al., 2017; Pahud & Ault, 2015). More than 33,000 HPV-related cancers are diagnosed annually, and approximately 62% of these cases are among women (CDC, 2017; Lai et al., 2017; Markowitz et al., 2014). Moreover, 70% of cervical cancers and 90% of genital warts in women are HPV related (CDC, 2017).

Prior to 2006, prevention of cervical cancer was limited to secondary preventative measures like early detection with the Papanicolau (Pap) test (González, Suárez, & Ortiz,

2015; Thomas, 2016). The Pap test is a safe, noninvasive, and inexpensive procedure used for detecting abnormal cells that might lead to cancer if left untreated; however, most women who are diagnosed with cervical cancer have never been screened for the disease (Glick, Clarke, Blanchard, & Whitaker, 2012; McKeever, Bloch, & Marrell, 2015). In the United States, racial and ethnic minority women and women from a lower socioeconomic status are 2 to 3 times more likely to develop cervical cancer because of persistent infection with genital HPV and are less likely to have a Pap test (American Cancer Society [ACS], 2017; Lechuga, Vera-Cala, & Martinez-Donate, 2016). For example, even though Hispanic women tend to have a higher incidence of cervical cancer, they are less likely to be screened for HPV-related cancers compared to African Americans and other non-Hispanic women (ACS, 2017; Lechuga et al., 2016; Roncancio, Ward, Carmack, Muñoz, & Cribbs, 2017). In fact, each year, approximately 2,000 Hispanic women are diagnosed with cervical cancer, and about 600 of them die from the disease (ACS, 2017).

Three vaccines against HPV are currently available, and although these vaccines do not treat existing infection, they are effective in preventing vaccine-specific HPV infections in adolescents and young adults (CDC, 2017; Dunne et al., 2014; Markowitz et al., 2014; Yang, Farmer, Wu, & Hung, 2016). To harness the full potential of these vaccines, all recommended doses should be administered before exposure to HPV (i.e., before engaging in sexual intercourse; Markowitz et al., 2014; Tota et al., 2011; Valentino & Poronsky, 2016). Receipt of the vaccine series before sexual debut is imperative because it is estimated that vaccinating young girls not only reduces the

prevalence of HPV by 64% but also can reduce the incidence of cervical cancer by greater than 90% (Markowitz et al., 2016; Roncancio et al., 2016). Per the Advisory Committee for Immunization Practice (ACIP), girls as young as 9 years of age through to 12 years of age should be vaccinated against HPV (CDC, 2017; Markowitz et al., 2014).

Three doses of the vaccine are recommended as a routine vaccination for girls 11 to 12 years of age (CDC, 2017). For individuals 13 to 26 years of age who have not been vaccinated or who have not completed the vaccine series, catch-up vaccination is recommended (CDC, 2017). However, despite the effectiveness of the vaccines and the ACIP's recommendation for HPV vaccination, national rates of completing the vaccine series remain low (CDC, 2017; Markowitz et al., 2014). Nationally, less than 50% of adolescent girls 13 to 17 years of age had received all three doses of the vaccine (CDC, 2017; Markowitz et al., 2014).

The percentage of adolescent girls who have completed the vaccine series varies by state, and from one state to another, this percentage has tended to be much lower among racial/ethnic minority girls (Jeudin, Liveright, del Carmen, & Perkins, 2014; Markowitz et al., 2014; Thompson, Rosen, Vamos, Kadono, & Daley, 2017). Adolescent Hispanic girls have higher rates than non-Hispanic White girls of initiating the vaccine series (Kepka, Ding, Bodson, Warner, & Mooney, 2015; Roncancio et al., 2017; Walker et al., 2017). However, Hispanic girls are less likely than non-Hispanic Whites or girls from other racial and ethnic minority groups to complete the vaccine series (Kepka, Ding, Bodson, Warner, & Mooney, 2015; Roncancio et al., 2017; Walker et al., 2017).

Although completing the vaccine series is crucial for all girls (CDC, 2017; Kepka et al., 2015), it is more important for Hispanic girls, given the high incidence of cervical cancer in this population (Kepka et al., 2015). However, administering the vaccine to racial and ethnic minorities could be challenging because these adolescents are less likely to have access to preventive care services and are more likely to receive low-quality health care (Gelman et al., 2013; Polonijo & Carpiano, 2013). They are also less likely to have permanent medical homes and are more likely to be underinsured or uninsured (Jarlenski, Baller, Borrero, & Bennett, 2016; G. K. Singh, Rodriguez-Lainz, & Kogan, 2013). Adolescents from racial and ethnic minority groups are also less likely to have at least one well-care visit per year (Gelman et al., 2013; Velasco-Mondragon, Jimenez, Palladino-Davis, Davis, & Escamilla-Cejudo, 2016). Because health care providers must administer the vaccine, having limited access to preventive services might prevent minority girls from completing the vaccine series.

I undertook this study to assess the extent to which having continuous health insurance coverage as well as a source of health care influenced completion of the HPV vaccine series among Hispanic female adolescents. Relative to the study, the implications for positive social change include informing guidelines and public health policies that support continuous access to preventive care services, regardless of insurance status. Reducing disparities in insurance coverage also could help to increase the uptake and completion of the HPV vaccine series among Hispanic adolescent girls. Boosting the completion rate of the vaccine series has the potential to reduce the risk of HPV infection among adolescent girls who are sexually active. Ultimately, there is the potential to

reduce the prevalence of HPV-related cervical cancer, which could then decrease the economic burden associated with HPV infection among Hispanic women.

Included this chapter is a summary of the literature pertaining to the current study, the research problem that was addressed, the purpose and nature of the study, and the research questions and hypotheses that guided this study. In this chapter, I will also provide the theoretical framework or conceptual foundation of the study; definitions of key terms and concepts related to the study; the limitations, scope, delimitations, and assumptions of the study; and the significance of the study. The chapter closes with a summary of the key points made in the chapter and a transition to Chapter 2.

Background of the Study

Prevalence of HPV infection tends to peak shortly after the onset of sexual activity (CDC, 2017; Pahud & Ault, 2015). Comparatively, this prevalence correlates with the rate of infection among adolescent girls and young female adults, who tend to have a disproportionately higher rate of infection than women in other age groups (Bosch et al., 2013; Gamble, Klosky, Parra, & Randolph, 2010; Valentino & Poronsky, 2016). Most HPV infections are asymptomatic (Pahud & Ault, 2015). In 90% of HPV infections, the infection is resolved by the immune system within 2 years (Guerra-Rodríguez, Champion, Morano-Monsivais, Olivares-Ornelas, & Vazquez, 2017; Pahud & Ault, 2015). For the remaining 10% of HPV infections, the infection will persist and can result in the development of HPV-related cervical cancer or genital warts (Cokkinides, Bandi, Siegel, & Jemal, 2012; Valentino & Poronsky, 2016).

Despite the effectiveness of the vaccines in preventing HPV infection, Hispanic girls are less likely than non-Hispanic White girls or girls from other racial and ethnic minority groups to complete the HPV vaccine series (Kepka et al., 2015; Roncancio et al., 2017; Walker et al., 2017). Data from a 2014 national survey showed that among Hispanic adolescents, 66.3% of girls initiated the series but only 48.3% completed the three-dose series (Jemal et al., 2013). At the state level, the HPV vaccine initiation rate among Hispanic girls 13 to 17 years of age living in Texas has been reported as 55%, with only 39.3% completing the series (Jemal et al., 2013). Despite having higher rates of initiating the vaccine series, adolescent girls from racial and ethnic minority groups (e.g., Blacks and Latinas), from low-income families, and who are publicly insured have been shown to be consistently less likely to complete the vaccine series when compared to their affluent and privately insured White counterparts (Chou, Krill, Horton, Barat, & Trimble, 2011; Jeudin et al., 2014; Niccolai, Mehta, & Hadler, 2011).

As the primary caregivers, Hispanic mothers are likely to have their daughter(s) vaccinated against HPV if they perceive that the vaccine is beneficial, safe, and affordable, and if their health care providers recommend the vaccine series (Ashting, Chávez, & Serrano, 2016; Berenson, 2015; Brown, Gabra, & Pellman, 2017). Gaining consent from the mothers is crucial to the likelihood of their daughters completing the vaccine series (Ferrer, Trotter, Hickman, & Audrey, 2014). However, the mothers' consent is dependent on other factors, such as characteristics of the subjects in question (i.e., girls' ages); concerns that the vaccine promotes sexual promiscuity; and awareness and knowledge of HPV, the vaccines, and HPV-related diseases (Dorell, Yankey,

Santibanez, & Markowitz, 2011; Ferrer et al., 2014; Laz, Rahman, & Berenson, 2012; Perkins, Brogly, Adams, & Freund, 2012; Thompson, Best, Vamos, & Daley, 2017). Other factors, such as being able to afford the vaccine, having health insurance, and having access to preventive services, also can affect the likelihood of daughters completing the vaccine series (Gerend, Zapata, & Reyes, 2013; Roncancio et al., 2016, 2017). However, there continues to be a lack of knowledge about the impact of insurance coverage and accessibility of preventive services on completing the HPV vaccine series. I filled a gap in the literature with this study by assessing the ways that continuity in insurance coverage and access to preventive services influenced completion of the HPV vaccine series among Hispanic girls.

Hispanics encounter many challenges that shape the conditions in which they live and affect their overall health and well-being (Velasco-Mondragon et al., 2016). They are more susceptible to being less educated, having limited access to health care services, having a lower socioeconomic status, and being underinsured (Velasco-Mondragon et al., 2016). Subsequently, Hispanic adolescents living in certain communities across the United States might be misinformed about the efficacy and safety of the HPV vaccines and might have limited access to preventive care services (Katz et al., 2016). Relative to the cost of the vaccine, these individuals might not have insurance and might not know about the Vaccine for Children Program, which provides the vaccine at no cost to individuals who are underinsured or uninsured (Reiter et al., 2014).

Problem Statement

Racial and ethnic disparities in HPV vaccination are likely due to a combination of different factors. Disparities in insurance coverage have been shown to affect access to and utilization of health care and also might be contributing to disparities in the health of Hispanic children (DeCamp & Bundy, 2012). Efforts have been made over the years to increase insurance coverage and to make health care more accessible to Hispanics (DeCamp & Bundy, 2012). However, many eligible Hispanic adolescents are less likely to be enrolled, and if enrolled, they are more likely to experience the effects of discontinuity in health insurance coverage (DeCamp & Bundy, 2012; DeVoe, Tillotson, Angier, & Wallace, 2015; Gelman et al., 2013).

Insurance coverage is crucial to the uptake of the vaccine because research has shown that initiation of the vaccine series is the lowest among girls who are uninsured (Reiter et al., 2014), yet very little is known about the impact of discontinuous insurance coverage on completing the HPV vaccine series. The HPV vaccine is administered over a 6-month period: baseline (0 months), 2 months, and 6 months; however, not everyone follows this schedule (Widdice, Bernstein, Leonard, Marsolo, & Kahn, 2011). Some girls might take longer to complete the vaccine series. During this time, individuals' insurance status might change (e.g., they might be without health insurance for a period of time, making it unlikely that they will complete the vaccine series; Cowburn, Carlson, & Lapidus, 2014). Few researchers have investigated the association between insurance continuity and completion of the vaccine series, and studies assessing the relationship between insurance coverage and completion of the vaccine series have yielded mixed

results (Cowburn et al., 2014; Federico, Abrams, Everhart, Melinkovich, & Hambridge, 2010; Tiro et al., 2012). The results of these studies were inconclusive and were further complicated by differences in how insurance status was measured. Furthermore, most researchers have tended to assess insurance coverage at a single point in time (Cowburn et al., 2014; Federico et al., 2010; Tiro et al., 2012). The issue with measuring insurance coverage at a single point in time is that it is difficult to assess how lapses in insurance coverage affect completing the vaccine series.

With this study, I sought to assess the influence of insurance coverage on HPV vaccine rates for adolescents. More specifically, I explored the extent to which gaps in insurance coverage influenced completion of the vaccine series for a nationally representative sample of Hispanic adolescents. Because health insurance increases the likelihood of accessing different types of health care facilities, the impact of insurance coverage and source of health care on completion of the HPV vaccine series were also assessed.

With programs like the Children Health Insurance Program, children can be insured regardless of the insurance status of their parents (DeVoe et al., 2016). However, although poorly understood, parental insurance coverage influences the likelihood of the children being continuously insured (DeVoe et al., 2015, 2016). Whether covered by private or public insurance, DeVoe et al. (2016) showed that the insured children of insured parents, in comparison to the insured children of uninsured parents, have a lower chance of experiencing gaps in insurance coverage. Understanding how fluctuations in insurance coverage affected the use of preventative services was important in identifying

new guidelines that can be implemented to boost HPV vaccination coverage among high-risk populations.

Purpose of the Study

The purpose of this quantitative study was to assess the relationship between discontinuity in insurance coverage, the type of medical facility used for health care, and HPV vaccination among Hispanic girls. The dependent variable in the study was HPV vaccination status (i.e., being fully vaccinated or not fully vaccinated), and the independent variables were insurance coverage (i.e., insurance status of the adolescent) and type of medical facility used to access health care. Covariates included maternal age, family income, maternal education, and health care provider recommendation to get the HPV vaccine series.

I measured the dependent variable, HPV vaccination status, as a dichotomous variable. The independent variables, insurance coverage and type of medical facility, were measured as nominal variables. The covariates, maternal age and family income, were measured as continuous variables; maternal education was measured as an ordinal variable; and health care provider recommendation was measured as a nominal variable.

Research Questions and Hypotheses

The study was guided by the following three research questions and the corresponding hypotheses:

Research Question 1: Is there a statistically significant relationship between health insurance coverage and the HPV vaccination status of Hispanic girls?

$H_0$1: There is no statistically significant association between health insurance coverage and the HPV vaccination status of Hispanic girls.

H_a1: There is a statistically significant association between health insurance coverage and the HPV vaccination status of Hispanic girls.

Research Question 2: Is there a statistically significant relationship between the type of medical facility used to access health care and the HPV vaccination status of Hispanic girls?

$H_0$2: There is no statistically significant association between the type of medical facility used to access health care and the HPV vaccination status of Hispanic girls.

H_a2: There is a statistically significant association between the type of medical facility used to access health care and the HPV vaccination status of Hispanic girls.

Research Question 3: Is there a statistically significant relationship between health insurance coverage, the type of medical facility used to access health care, and the likelihood of completing the HPV vaccine series?

$H_0$3: There is no statistically significant association between health insurance coverage, the type of medical facility used to access health care, and the likelihood of completing the HPV vaccine series.

H_a3: There is a statistically significant association between health insurance coverage, the type of medical facility used to access health care, and the likelihood of completing the HPV vaccine series.

Theoretical Background

I based this study on the tenets of the socioecological model (SEM), which was used to explain the relationship between individuals' health and their environments. Based on the assumption that health is the result of several factors, the SEM theorizes that the social and physical environments, as well as organizational factors, policies, and regulations, interact to determine the health and health behaviors of individuals (Baral, Logie, Grosso, Wirtz, & Beyrer, 2013; Paat, 2013). The SEM is the culmination of the work of Bronfenbrenner (1977); McLeroy, Bibeau, Steckler, and Glanz (1988); Stokols (1992; and Stokols, Grzywacz, McMahan, & Phillips, 2003). Bronfenbrenner's ecological systems theory emphasized the relationship between individuals and their environments; McLeroy et al.'s ecological model of health behaviors highlighted the different levels of influence on health behaviors; and the social ecological model of health promotion (Stokols, 1992; Stokols et al., 2003) outlined the assumptions that support the SEM (Baral et al., 2013; Nyambe, Van Hal, & Kampen, 2016).

As shown in Figure 1, the SEM is divided into five levels of influence that determine health outcomes or reduce risks to given health outcomes: (a) individual-related factors or intrapersonal factors, (b) interpersonal factors, (c) organizational-related factors, (d) community-level factors, and (e) public policy-level factors (Baral et al., 2013; Chimphamba-Gombachika et al., 2012). Individual-related factors are based on characteristics of the individual (i.e., beliefs, attitudes, and knowledge; Baral et al., 2013; Chimphamba-Gombachika et al., 2012). Interpersonal factors refer to individuals' social groups or networks (i.e., family members, friends, spouses/partners, health care

providers; Baral et al., 2013; Chimphamba-Gombachika et al., 2012). Organizational-related factors are formal or informal factors, such as rules and regulations, that regulate the operations of social institutions or organizations (Baral et al., 2013; Chimphamba-Gombachika et al., 2012). Community-level factors relate to the relationships between and among different entities (i.e., local, state, national, and federal), and public policy-level factors relate to national, state, and local health laws and policies (Baral et al., 2013; Chimphamba-Gombachika et al., 2012).

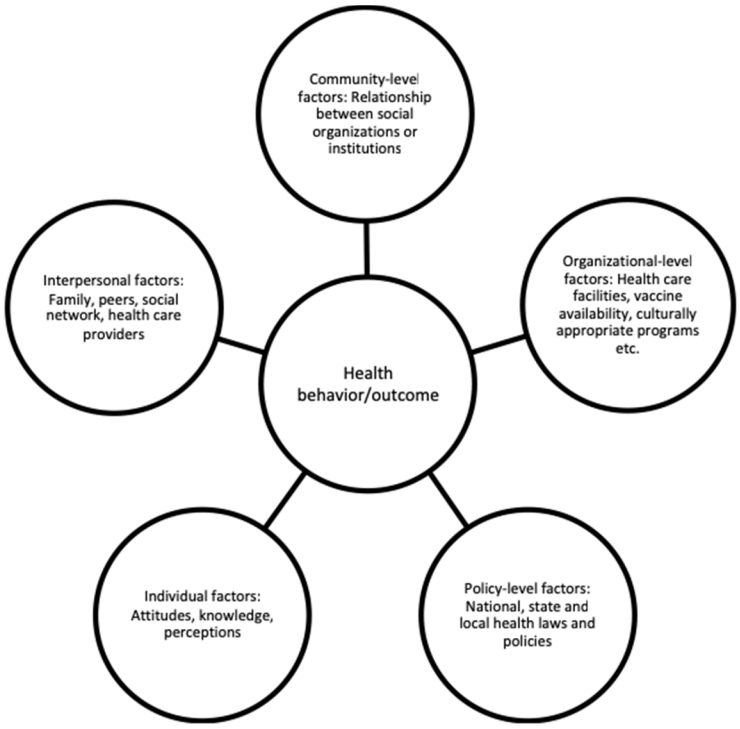

Figure 1. Socioecological model. Adapted with modifications from "The social ecological model: A framework for prevention," by CDC, 2015a. Retrieved from http://www.cdc.gov/violenceprevention/overview/social-ecologicalmodel.html

I selected the SEM to understand the different determinants of a given health behavior, such as vaccine usage, and how these determinants interact to influence the decision to engage in such behavior. For example, as shown in Figure 2, Hispanic

mothers' perceptions of the susceptibility of their children to HPV-related diseases, the barriers to accessing the vaccine, and the perceived benefits of the vaccine might influence their decision to vaccinate their children against HPV. Likewise, their decision to accept the HPV vaccine is shaped by their social networks, the recommendation of health care providers, accessibility of health care facilities used for HPV health-related issues, and the availability of the vaccine at these locations. The mothers' decision to vaccinate their daughters against HPV also is affected by their perceptions of the risk of HPV based on community levels of the disease, the financial cost of obtaining the vaccine, health coverage, whether state policy mandates HPV vaccine for school entry, and whether state-level regulations support the availability of HPV-related educational materials that are culturally appropriate (Fernandez, Allen, Mistry, & Kahn, 2010; Nyambe et al., 2016).

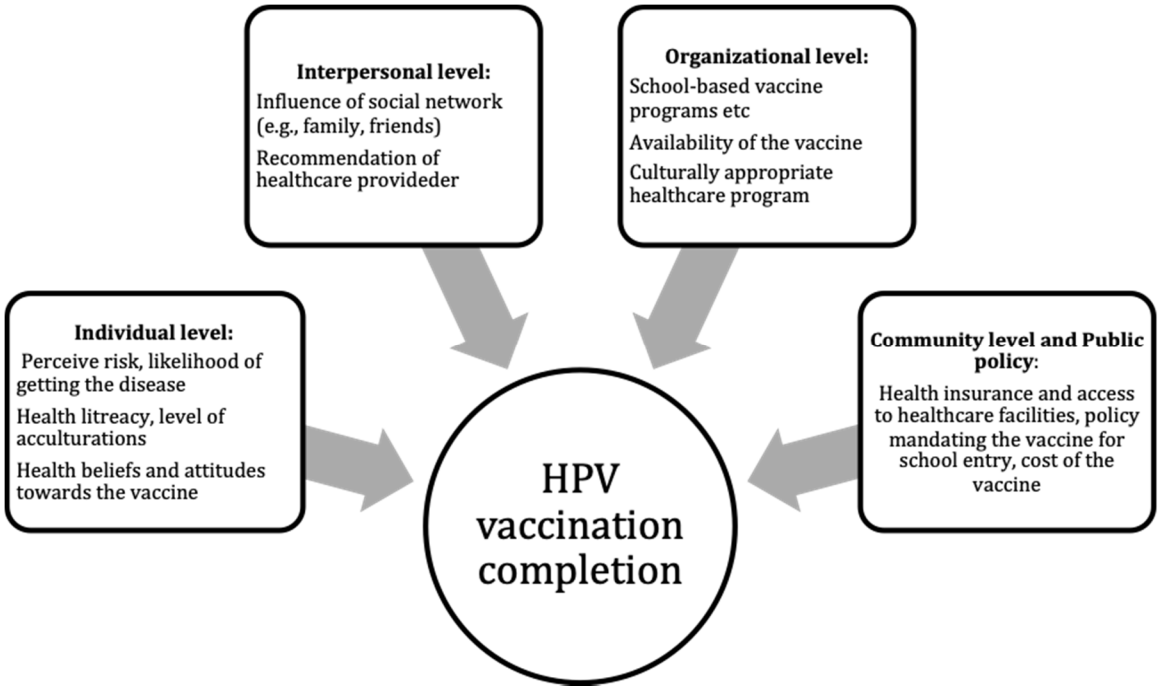

Figure 2. Socioecological framework for HPV vaccine uptake. Adapted with modifications from "Screening and Vaccination As Determined by the Social Ecological Model and the Theory of Triadic Influence: A Systematic Review," by A. Nyambe et al., 2016, *BMC Public Health, 16*, p. 1166. Copyright 2016 by the A. Nyambe et al. Adapted with permission.

Nature of the Study

I employed a quantitative, cross-sectional design in this study. I analyzed secondary data from the 2016 National Immunization Survey-Teen (NIS-Teen; CDC, 2016a) to assess the relationship between insurance coverage, the type of medical facility used to access health care, and completion of the HPV vaccine series among Hispanic girls. After downloading and cleaning the data, I used logistic regression to determine the significance of the relationship between health insurance coverage, the type of medical facility used to access health care, and completion of the HPV vaccine series among adolescent Hispanic girls.

Operational Definitions

Discontinuity in health insurance coverage: Having a lapse or disruption in insurance coverage. This includes individuals who are currently insured but were uninsured at some point, individuals who are currently uninsured but were insured at some point, and individuals who are currently insured and never uninsured (CDC, 2016b). This definition also includes individuals who are currently uninsured and were never insured.

Insurance coverage: Having insurance coverage, whether private or public health insurance (CDC, 2016b).

Type of medical facility: The facility an individual used to access their primary care provider. This includes public health-operated clinics, hospital-based clinics, or private practice (CDC, 2016b).

Vaccination status: Whether girls are fully vaccinated with the recommended HPV vaccines (CDC, 2016b). A "no" response indicates that they were not vaccinated, and a "yes" response indicates that they had received at least one dose of the HPV vaccine series.

Assumptions of the Study

I made several key assumptions in this study. The first assumption was that the instrument used to collect the data was valid and reliable based on its use in other HPV vaccination studies. Another assumption was that the collected data were free of any interviewer bias. I also assumed that the collected data were truthful based on the knowledge and ability of the respondents.

Scope and Delimitations

The focus of the study was on adolescent Hispanic girls, so the findings cannot be generalized to all adolescent girls. Relative to completing the vaccine series, I focused only on the HPV vaccine in girls in this study; therefore, the findings cannot be generalized to boys and other multidose vaccines. The collected data were limited to the responses given by the responding parents or guardians, who determined the eligibility of the adolescents present in the household and provided all information pertaining to the adolescents. The NIS-Teen collected data only on adolescents living in the United States and select territories at the time of the interview.

Limitations of the Study

The study was subject to several limitations inherent in the use of secondary data. In using archival NIS-Teen data, this study was restricted to questions asked in the survey and was limited to the definitions, values, and nature of the variables in the NIS-Teen data set. The NIS-Teen data set contains provider-verified HPV vaccination information; however, self-reported demographics and other relevant information also might have led to an overestimation or underestimation of the variables in question. Given the propensity for bias with self-reported information, this bias could have affected the true nature of the relationship between these factors and completion of the HPV vaccine.

Significance of the Study

The higher the rate of the HPV vaccine series completion is among adolescents, the more likely is the chance of reducing the risk of HPV-related disease later in adulthood (Wisk, Allchin, & Witt, 2014). Access to a source of health care and insurance

coverage are both integral to this process, so it was important that any potential barriers related to these constructs be identified and disseminated. Relative to positive social change, alleviating issues with the source of health care accessed and insurance coverage could help to increase the completion rate of the HPV vaccine series (Lu et al., 2018). In turn, boosting the vaccine series completion rate could reduce not only the risk of HPV-related infection but also the prevalence of cervical cancer and, ultimately, decrease the economic burden associated with HPV infection among Hispanic women.

Summary

In this chapter, I introduced insurance coverage, discontinuity in health insurance coverage, and source of health care as potential contributors to the disparity in completion of the HPV vaccine by adolescent Hispanic girls. Completing the HPV vaccine series is crucial for all girls, but for Hispanic girls, it is more important given the high incidence of cervical cancer among Hispanic female adults (Kepka et al., 2015). Administering the vaccine to adolescents from racial and ethnic minority groups is challenging because they are more likely to have limited access to preventive care services and be underinsured than to be continuously insured (Katz et al., 2016; Reiter et al., 2014). They also are less likely to have permanent medical homes and at least one well-care visit per year (Gelman et al., 2013; Velasco-Mondragon et al., 2016). Because health care providers are essential to administering the HPV vaccine series, discontinuous insurance coverage and limited access to a source of health care have the potential to interfere with completion of the vaccine series.

Employing a quantitative study design, I assessed the extent to which insurance coverage and the type of medical facility used to access health care affected the likelihood of Hispanic adolescent girls completing the HPV vaccine series in this study. Insurance coverage and having a source of health care might not resolve the issue of the underutilization of the HPV vaccine among Hispanic adolescents across the United States, but these constructs might help to highlight areas that can be targeted when formulating guidelines and policies that will aid in increasing the uptake of the HPV vaccine among this ethnic group. In Chapter 2, I will present a detailed discussion of the theoretical foundation of the study, the literature search strategy, and a review of the literature, with an emphasis on gaps in insurance coverage and immunizations among Hispanic girls living in the United States.

Chapter 2: Literature Review

Introduction

Increasing the completion rate of the HPV vaccine series among adolescent girls has the potential to significantly reduce the prevalence and mortality rate of cervical cancer later in life (Valentino & Poronsky, 2016). Despite the effectiveness of the HPV vaccine and the ACIP's recommendation for vaccinations (Fishman, Taylor, & Frank, 2016; Vielot, Butler, Brookhart, Becker-Deps, & Smith, 2017), completion of the vaccine series continues to be low among adolescent girls. HPV vaccine completion among girls varies by age (Niccolai et al., 2011); state (Walker et al., 2017); race and ethnicity (Wisk et al., 2014); and socioeconomic status (Wisk et al., 2014). It also varies by insurance status and by the recommendation made, or not made, by health care providers to have the vaccine series (Gilkey et al., 2016; Jarlenski et al., 2016).

Completing this review of the literature was relevant to gaining a better understanding of the factors contributing to disparities in completing the HPV vaccine series. In Chapter 2, I provide an explanation of the ways that the SEM can be used as a framework to understand the reasons for the low completion rate of the HPV vaccine series. I present an overview of HPV, HPV-related diseases, and the HPV vaccines currently available to prevent HPV-related diseases. I also present a review of the literature relative to the continuity of insurance coverage and other barriers to the uptake of the vaccine. The chapter concludes with a discussion of the ways that gaps in insurance coverage and racial and ethnic disparities influence the uptake of the vaccine among Hispanic adolescent girls.

Literature Search Strategy

I conducted a comprehensive literature review to identify research on insurance continuity, HPV vaccine disparities, and racial and ethnic disparities and HPV vaccine completion among adolescents. The databases used in the search for relevant literature included Google Scholar, PubMed, MEDLINE, APA PsycNET, EBSCOhost, CINAHL, and Science Direct. I gathered additional resources from ProQuest Theses and Dissertations database and the U.S. National Library of Medicine. The key search terms used either in combination or isolation to locate peer-reviewed articles were *insurance*, *insurance coverage*, *private insurance*, *public insurance*, *gaps in insurance*, *discontinuity in insurance*, *continuous insurance*, *vaccination*, *racial and ethnic minorities*, *human papillomavirus (HPV)*, *HPV vaccine*, *HPV vaccination initiation and completion*, *HPV vaccine and insurance*, *vaccine-preventable diseases*, *cervical cancer prevention*, *Latino health*, *immigrants and HPV*, *immigrants' health*, *African American health*, *HPV risk perception*, *health care facilities*, *preventive service*, *health care*, *well-care visit*, *provider recommendation*, *socioecological model*, *adolescents' health*, *adolescents' health disparity*, and *adolescents' vaccines*. Relative to this study, I set the limit to research articles published within the last 5 years in most databases, and as deemed necessary, I extended the limit to 10 years in other databases. I sought articles published between 10 and 20 years ago based on their relevance to more recent literature and the current study. Relatedly, the number of publications addressing insurance coverage continuity as a factor in vaccination completion was limited; therefore, I expanded the scope of the

search to include as many studies as possible based on their relevance to the topic of interest.

Theoretical Foundation

Socioecological Model

This study was framed by the perspectives of the SEM, which is based on Bronfenbrenner's (1977) ecological systems theory; McLeroy et al.'s (1988) ecological model of health behaviors; and the social ecological model of health promotion (Stokols, 1992; Stokols et al., 2003). The SEM posits that five levels of influence determine behavior: (a) intrapersonal or individual characteristics such as beliefs, knowledge and, attitudes; (b) interpersonal factors; (c) organizational/institutional factors; (d) community-related factors; and (e) societal level factors or public policies factors. (Baral et al., 2013; Chimphamba-Gombachika et al., 2012; Nyambe et al., 2016; Paat, 2013; Schölmerich & Kawachi, 2015). Figure 3 shows the interconnection between these factors and the ways that they influence each other to determine the uptake of the HPV vaccine (see Lanning, Golman, & Crosslin, 2017).

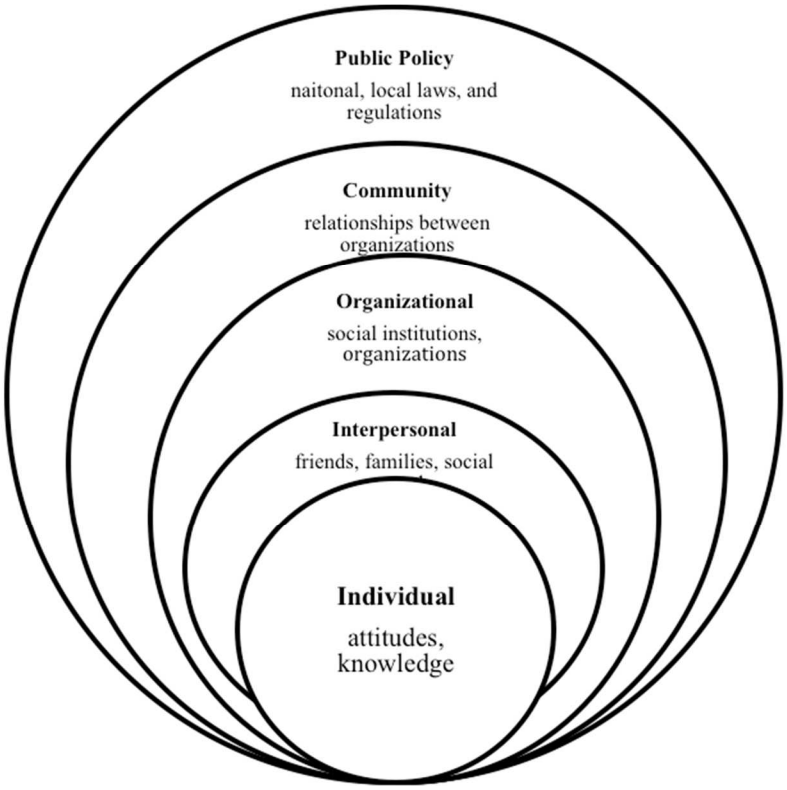

Figure 3. Socioecological model of factors influencing HPV vaccination. Adapted from "Improving Human Papillomavirus Vaccination Uptake Among College Students: A Socioecological Perspective," by B. Lanning, M. Golman, & K. Crosslin, 2017, *American Journal of Health Education, 48*(2), p. 118. Copyright 2018 by Copyright Clearance Center. Adapted with permission.

Individual or intrapersonal factors are based on characteristics that influence given health behaviors. In this case, the characteristics of the mothers and the daughters affect completion of the HPV vaccine series (Fernandez et al., 2010; Ferrer, Audrey, Trotter, & Hickman, 2015). These characteristics include maternal acceptance of the vaccine and willingness to vaccinate their daughters against the virus (Fernandez et al., 2010; Ferrer, Audrey, et al., 2015). Maternal acceptance of the vaccine depends on the mothers' ages and beliefs, attitudes, and knowledge about HPV and the HPV vaccines (Fernandez et al., 2010; Ferrer, Audrey, et al., 2015). It also depends on maternal

socioeconomic status, educational attainment, level of health literacy, and level of acculturation if they are immigrants (Ciampa et al., 2012; Kepka et al., 2015; Walter, Murphy, Frank, & Baezconde-Garbanati, 2017; Wisk et al., 2014). As for adolescents, their ages, what they know about HPV and the vaccines, and whether their friends have or have not received the vaccine can influence their receipt of the vaccine (Fernandez et al., 2010; Ferrer, Audrey, et al., 2015). The decision to vaccinate or get the vaccine is also influenced by the risk perceptions of mothers and daughters, their perceptions of susceptibility to the infection, severity of the disease, and perceived benefits of the vaccine to protect against the infection or cervical cancer (Fernandez et al., 2010; C. E. Hansen, Credle, Shapiro, & Niccolai, 2016).

Interpersonal factors refer to the people in an individuals' social networks or support groups who could influence receipt and completion of the vaccine series (Fernandez et al., 2010; Ferrer, Audrey, et al., 2015; Lanning et al., 2017). Among these sources of influence are family members, friends, health care providers, and spouses or partners (Lanning et al., 2017). Social influence is a known predictor of the uptake of the vaccine (Fernandez et al., 2010; Ferrer, Audrey, et al., 2015). For example, if mothers believe that their friends and family members approve of vaccinating young girls against HPV, they are more likely to have their daughters vaccinated against HPV (Fernandez et al., 2010; Ferrer, Audrey, et al., 2015). Likewise, if their health care providers recommend the vaccine, mothers are more likely to have their daughters vaccinated (Gilkey, Malo, Shah, Hall, & Brewer, 2015; Warner et al., 2017). Relative to the

daughters, if they perceive that their mothers approve of getting the vaccine, it will increase their chances of being vaccinated (Warner et al., 2017).

Organizational or institutional factors are formal or informal rules and regulations that regulate the availability of the HPV vaccine. In the United States, the U.S. Food and Drug Administration (FDA, 2018) approves the vaccine. The ACIP recommends the vaccine, decides who should be vaccinated, at what age, and how often the vaccine should be administered (CDC, 2016e). Vaccine manufacturers, commercial distributors, and state and local governments work together to develop or improve existing infrastructure to deliver the HPV vaccine series (Fernandez et al., 2010; Markowitz et al., 2012; Shefer et al., 2012). Relative to the cost of the vaccine, public and private entities work together to make the vaccine more accessible (CDC, 2015b, 2018). However, at this level, the lack of an established adolescent vaccination program and the lack of a clear plan to maximize the uptake of the vaccine series also influence the HPV vaccine completion rate (Fernandez et al., 2010; Ferrer, Audrey, et al., 2015).

Community-level factors refer to local, state, national, and federal governing bodies that influence the uptake of the HPV vaccine. The cost of the vaccine affects its uptake (Fernandez et al., 2010; Ferrer, Trotter, Hickman, & Audrey, 2015; Warner et al., 2017). The HPV vaccine is one of the most expensive vaccines available (CDC, 2015b, 2018). For individuals with private or public insurance, the vaccine is covered by most private insurance plans and is available at no cost for individuals who are publicly insured; however, not all adolescents have private insurance or are eligible for federal or state-level programs that cover the cost of the vaccine (Lindley, Smith, & Rodewald,

2011). Also, not everyone without insurance can afford to pay for the vaccine themselves. Therefore, the lack of insurance and the lack of financial means to cover the cost of the vaccine mean that completion of the vaccine series is highly unlikely (Fernandez et al., 2010; Ferrer, Trotter, et al., 2015).

The final level of influence encompasses public policies. These national, state, and local health laws and policies not only govern but also affect vaccine uptake. These policies include ordinances at the state and federal levels that make the vaccine mandatory for school entry or entrance into the United States (Fernandez et al., 2010). The policies also include mandates for increasing the availability of educational tools at clinics, schools, doctors' offices, and so on (Fernandez et al., 2010). Raising awareness of and increasing knowledge about HPV and the HPV vaccines are instrumental to the receipt and completion of the vaccine series (Lai et al., 2017). However, making the vaccine mandatory is controversial, and only a few states have succeeded in making HPV vaccination mandatory for school entry (Fernandez et al., 2010). Mandating the vaccine for school entry could be more of a hindrance than a facilitator of the uptake of the vaccine (Fernandez et al., 2010).

Three groups of researchers have attempted to explain the uptake of the HPV vaccine using an integrated model based on the tenets of the SEM (Downs, Scarinci, Einstein, Collins, & Flowers, 2010; Fernandez et al., 2010; Ferrer et al., 2014). To identify the factors that inhibit or facilitate uptake of the HPV vaccine among young women, Ferrer et al. (2014) employed a systematic approach and found that parents, health care providers, and policymakers drove receipt of the HPV vaccine among young

women. Factors that negatively influenced the uptake of the vaccine included the cost of the vaccine, lack of health care provider recommendation, and cultural and religious values (Ferrer et al., 2014). Therefore, although health care providers and policymakers can have a positive effect on uptake of the vaccine, the lack of health care provider recommendations and religious values both can have a negative effect on the uptake of the vaccine.

To maximize the uptake of the HPV vaccine among high-risk adolescents, a multilevel approach is needed (Downs et al., 2010). According to Downs et al. (2010), this approach takes into consideration all levels of influence, beginning with individual-related factors and continuing with factors related to social networks, organizational-related factors, community, and public policies. Because this multilevel approach is more holistic, it is useful and more realistic as a foundation for improving uptake of the vaccine. Fernandez et al. (2010) also showed that personal as well as external factors, such as interpersonal, organizational, community and societal-related factors influence the intent to vaccinate against HPV as well as the acceptability of the vaccine. Moreover, Fernandez et al. posited that employing a multilevel approach to address issues with the uptake of the HPV vaccine series would likely enhance its uptake, unlike approaches that target a single factor like maternal attitudes.

Justification for Using the Socioecological Model

The health belief model (HBM; Hochbaum, 1958; Rosenstock, Strecher, & Becker, 1988); the theory of planned behavior (TPB; Ajzen, 1991; Ajzen & Madden, 1986); and the theory of reasoned action (TRA; Fishbein & Ajzen, 1977, 1980) are the

most commonly used theoretical approaches to explain behaviors among adolescents relevant to the HPV vaccine. However, the problem with the use of these models is that they capture only the psychological factors that affect the decision to accept the vaccine or the intent to have daughters vaccinated against HPV. The HBM, for example, offers six psychological factors that predict the likelihood of mothers allowing their daughters to be vaccinated against HPV: susceptibility to HPV (perceived susceptibility); severity of the disease (perceived severity); benefits of the vaccine (perceived benefits); barriers to obtaining the vaccine (perceived barriers); self-efficacy (i.e., mothers' belief in their ability to act on information about the vaccine and HPV-related diseases); and call to action (i.e., having daughters complete the vaccine series; Bowyer, Forster, Marlow, & Waller, 2014; Morales-Campos, Markham, Peskin, & Fernandez, 2013; Spleen, Klushman, Clark, Dignan, & Lengerich, 2012).

The basic tenet of the TRA is that the intention to act on given cues is determined by behaviors (Fishbein & Ajzen, 1977, 1980). This intention is determined by two key elements, namely, attitudes toward the behaviors in question and subjective norms toward such behaviors (Fishbein & Ajzen, 1977, 1980). Subjective norms are individuals' perceptions of what others think about their adopting the behaviors in question (Fishbein & Ajzen, 1977, 1980). Relative to HPV vaccination, researchers have used the TRA to predict or identify the factors that influence mothers' intentions to have their daughters vaccinated against HPV (Natan, Aharon, Palickshvili, & Gurman, 2011; Reynolds & O'Connell, 2012) and to predict which elements influence health care providers to

recommend the HPV vaccine to the mothers of adolescent daughters (Roberto, Krieger, Katz, Goei, & Jain, 2011).

The TPB is an extension of the TRA (Ajzen, 1991; Ajzen & Madden, 1986). Because individuals might have little control over some behaviors, the TPB posits that individuals' perceived control over given behaviors influences the intention to perform the behaviors in question (Ajzen, 1991; Ajzen & Madden, 1986). Concerning the HPV vaccine, researchers have used the TPB to assess mothers' intentions to talk to their daughters about sex, HPV, and other HPV-related matters relative to the vaccine (Askelson et al., 2011b). It has been used to assess adolescents' psychosocial factors that predict the likelihood of their being vaccinated against HPV (Bowyer et al., 2014) and to assess health care providers' intentions to talk to young women about sex-related matters and the HPV vaccines (Askelson et al., 2011a).

Theories have been used to guide the development of interventions to maximize uptake of the HPV vaccine (Ferrer, Audrey, et al., 2015). As such, it was important to identify the most appropriate framework to guide such development. Although the constructs of the HBM have been used to explain why mothers are not complying with the recommendation to vaccinate their daughters against HPV, they have not been used to consider factors other than maternal-related perceptions that also could influence uptake of the HPV vaccine series (Ferrer, Audrey, et al., 2015). Similarly, even though the TRA and TPB have been used to understand the intentions of mothers, adolescent daughters, and physicians toward discussing HPV-related matters, they have failed to capture factors other than intention that could influence vaccinating young girls against HPV (Ferrer,

Audrey, et al., 2015). As established by the SEM, in addition to individual characteristics, family members, friends, policymakers, and societal and community-level factors are considered likely to influence uptake of the HPV vaccine (Lanning et al., 2017). According to Downs et al. (2010), this approach is more likely than approaches that target only the factors relating to the individuals to enhance uptake of the vaccine series.

Literature Review Related to Key Variables and Concepts

Overview of HPV

Genital HPV is the most common STI in the United States (CDC, 2017). The infection is so common that for persons who are sexually active, there is a 75% chance that they will be infected with at least one type of HPV at some point in life (CDC, 2017; Tota et al., 2011; Valentino & Poronsky, 2016). In the United States alone, approximately 80 million people are infected with HPV, and each year, approximately 14 million newly infected cases are reported, with nearly 50% of the cases occurring in persons 15 to 24 years of age (CDC, 2017; Tota et al., 2011; Valentino & Poronsky, 2016).

HPV is transmitted through genital contact and is directly transmitted from infected persons to their sexual partners. Transmission of HPV is not limited to vaginal intercourse; transmission also can occur during oral and anal sex (Valentino & Poronsky, 2016). Because HPV is transmitted through sexual contact, the risk of infection is linked to sexual behaviors. Thus, the age when girls begin to engage in sexual activity, have multiple sexual partners, and not use condoms during sexual intercourse is associated with a higher risk of being infected with HPV (Chelimo, Wouldes, Cameron, & Elwood, 2013; Valentino & Poronsky, 2016). Likewise, having a history of prior STIs and

engaging in nonmonogamous sexual relationships also are associated with a higher risk of being infected with HPV (Chelimo et al., 2013; Valentino & Poronsky, 2016).

More than 150 strains or serotypes of HPV have been identified, but only about 40 of these serotypes are known to infect humans (CDC, 2017). Even though HPV infections are common, most infections occur without any symptoms and are cleared by the immune system within 2 years (CDC, 2017). As a result, most people are not aware of being infected with HPV and can easily spread the virus to their sexual partners without knowing it (CDC, 2017). Some infections can persist for years, and if left untreated, they might progress to cancer (CDC, 2017). Hence, sexually transmitted HPV serotypes are classified as low risk or high risk based on their cancer-causing potential (CDC, 2017).

Low-risk HPVs do not cause cancer, but they can cause warts on or around the genitals and anus (CDC, 2017). HPV Serotypes 6 and 11, for example, are low-risk serotypes associated with 90% of all genital warts (CDC, 2017). High-risk serotypes can cause cancer. There are several high-risk serotypes, but HPV Serotypes 16 and 18 are the most common and are associated with a high percentage of all HPV-related cancers (CDC, 2017).

HPV-Related Cancers

According to CDC estimates, about 30,000 HPV-related cancers are diagnosed each year in the United States, with 63% of these cancers affecting women (as cited in McGhee et al., 2017). Of all HPV-related cancers, 87% of them are cancer of the cervix (Forman et al., 2012). In the United States, 70% of cervical cancers are HPV related;

each year, more than 12,820 new cases of cervical cancers are diagnosed, and of these cases, 4,000 will result in death (ACS, 2017).

Compared to the high rate of HPV-related cervical cancer, the incidence of other HPV-related cancers remained relatively low for decades. However, in recent years, the frequency of these cancers has increased (Saslow et al., 2016). Sixty-nine percent of vulvar cancers, 75% of vaginal cancers, and 70% of oropharyngeal cancers are HPV related (CDC, 2017; McGhee et al., 2017; Saslow et al., 2016). Each year in the United States, 1,400 cases of vulvar cancer, 400 cases of vaginal cancers, and 7,000 cases of oropharyngeal cancers are diagnosed (McGhee et al., 2017).

Before 2006, prevention of cervical cancer was limited to secondary preventative measures such as screening and early detection with the Pap test (González et al., 2015; Thomas, 2016). The Pap test is a safe and noninvasive screening tool used to detect abnormal cells that might lead to cancer if left untreated. However, most women who are diagnosed with cervical cancer have never been screened for the disease (Glick et al., 2012; McKeever et al., 2015). In the United States, women from racial and ethnic minority groups and women from a lower socioeconomic status are 2 to 3 times more likely to develop cervical cancer because of persistent infection with genital HPV and are less likely to have had a Pap test (ACS, 2017; Lechuga et al., 2016). For example, even though Hispanic women tend to have a higher incidence of cervical cancer, they are less likely than Blacks and other non-Hispanic White women to be screened for HPV-related cancers (ACS, 2017; Lechuga et al., 2016; Roncancio et al., 2017). Likewise, even though Blacks have the highest prevalence of HPV infections, they also are less likely to

be screened for HPV-related cancers (ACS, 2017; Lechuga et al., 2016; Roncancio et al., 2017).

Cervical cancer is the only HPV-related cancer with guidelines for screening and a reliable test (CDC, 2016c). Hence, by adhering to screening guidelines, the incidence of cervical cancer is modifiable (CDC, 2016c). The availability of such guidelines and reliable tests for oropharyngeal, vaginal, and vulvar HPV-related cancers could help to reduce the rate (CDC, 2016c), but given the high frequency of these cancers, other measures should be employed to help to reduce their incidence (CDC, 2017; McGhee et al., 2017; Saslow et al., 2016). In these situations, a vaccine against HPV would be the most beneficial. Such a vaccine against HPV would not replace the Pap test or other screening tools, but it could help to reduce the incidence and mortality rate of HPV-related cervical cancers. Similarly, a vaccine against HPV could help to reduce the prevalence of noncervical, HPV-related cancers (Jemal et al., 2013).

HPV Vaccine

Before 2006, there were no vaccines to prevent or reduce the risk of HPV infection. In 2006, the FDA approved three vaccines against HPV infection (as cited in FDA, 2018). The first in the series of HPV vaccines to be approved in 2006 was a bivalent HPV vaccine (2vHPV). This vaccine protects against HPV Serotypes 16 and 18 (Harper & DeMars, 2017). In 2009, the FDA approved a quadrivalent HPV vaccine (4vHPV). This vaccine targets HPV Serotypes 6, 11, 16 and 18 (Angioli et al., 2016). Finally, in 2014, a nine-valent vaccine (9vHPV) was introduced to the market. This vaccine targets HPV Serotypes 6, 11, 16 and 18 as well as 31, 33, 45, 52, and 58 (CDC,

2017; Draper et al., 2013). All three vaccines were designed to prevent infections with HPV Serotypes 16 and 18, the most common serotypes causing cancer. In addition, 4vHPV targets HPV Serotypes 6 and 11, both of which are responsible for 90% of genital warts, and 9vHPV targets five other high-risk HPV serotypes (CDC, 2017).

The HPV vaccine stimulates the immune system to produce antibodies that are protective against vaccine-related HPV serotypes (Harper & DeMars, 2017). Comparative analysis of clinical studies supporting the approval of HPV vaccines indicated that antibodies against 2vHPV and 4vHPV provided protection against 90% to 100% of infection caused by HPV Serotypes 16 and 18 (Einstein et al., 2011a, 2011b; Einstein, Levin, et al., 2014; Einstein, Takacs, et al., 2014). HPV vaccines also prevent the formation of precancerous cervical lesions or the transformation of cervical cell associated with persistent infection with HPV Serotypes 16 and 18 (Einstein et al., 2011a, 2011b; Einstein, Levin, et al., 2014; Einstein, Takacs, et al., 2014). In addition, 2vHPV and 4vHPV have been found protective against HPV infection in other body sites. Antibodies against 2vHPV have reduced the number of vulvar HPV infection in young girls by 50%, and antibodies against 4vHPV have prevented 100% of vulvar and vaginal lesions caused by HPV infection (Kreimer et al., 2011).

In similar studies, 9vHPV antibodies have been shown to protect against infection caused by all nine vaccine-related serotypes in all study participants (Joura et al., 2015). Furthermore, researchers have estimated that by including five additional high-risk serotypes in the 9vHPV vaccine, the vaccine has the potential to prevent more than 90% of cervical cancer (De Sanjosé et al., 2010; Joura et al., 2014; Serrano et al., 2012).

Overall, the HPV vaccines are protective against infections caused by the serotypes of HPV included in them and they have the potential to reduce the incidence of HPV-related cancers caused by these serotypes.

A vaccine's effectiveness is assessed by how efficiently it is taken up by the population and the level of protection that it subsequently provides through what is called herd immunity (Kahn et al., 2012). Seven years after the introduction of the HPV vaccines, Drolet et al. (2015) noted that when vaccine coverage rate exceeded 50%, the vaccine significantly reduced the prevalence of HPV at the population level. This result suggested that with higher rates of completion, the prevalence of HPV infection has become lower, which means more protection for individuals who are unvaccinated against HPV (Drolet et al., 2015; Harper & DeMars, 2017). The current study supports not only the importance of being vaccinated against HPV but also the need to improve the rate of completing the vaccine series within the specified time frame.

Markowitz et al. (2016) provided additional evidence supporting the efficacy of the vaccine. Using data from the National Health and Nutrition Examination Survey, these researchers demonstrated that the HPV vaccine significantly reduced the prevalence of HPV infection among adolescent girls. Because the vaccine was not approved until late 2006, the researchers used data from 2003 to 2006 to represent the time before the vaccine and data from 2009 to 2012 to represent the time after the vaccine. Participants whose HPV status was determined by HPV genotyping were interviewed during each time frame. The genotyping was included in their analysis.

Markowitz et al. (2016) found among girls 14 to 19 years of age, the incidence of HPV infection caused by HPV Serotypes 6, 11, 16 and 18 was reduced by 64%, that is, from 11.5% prevaccine to 4.3% postvaccination. They also noticed a 34% reduction in HPV prevalence among participants 20 to 24 years of age. For HPV 16 and 18 alone, they observed a 50% reduction in infection caused by these two high-risk serotypes. Even with the low number of participants who completed the three-dose vaccine series, their results showed that the HPV vaccine was highly effective in preventing HPV infection and that over time, this reduction in the incidence of vaccine-type HPV serotypes could reduce cervical cancer and other HPV-related cancers.

In addition to reducing the prevalence of HPV infection, the HPV vaccine series provides partial protection against other cancer-causing HPV serotypes not included in the vaccine (Ferris et al., 2014; Petrosky et al., 2015). This information is valuable because without directly targeting serotypes of HPV not included in the vaccine, antibodies produced against these strains will be able to offer some protection against these other strains. Another area of interest in the effectiveness of the HPV vaccines is the duration of protection, that is, the amount of time (in years) that one is protected against HPV after receipt of the vaccine. From a clinical perspective, the duration of protection is critical to preventing HPV infection. For 2vPHV and 4vHPV, after receipt of all three doses, the duration of protection is currently estimated to be 8 and 9 years, respectively (Naud et al., 2014). However, because the nine-valent HPV vaccine is relatively new, its duration of protection is not known. The duration of protection of the vaccine is important not only to clinicians but also to public health officials because the

longer the duration of protection, the greater the chances of preventing cervical and other cancers, such as vaginal, vulvar, and oropharyngeal cancers, that are HPV-related (Harper & DeMars, 2017; Naud et al., 2014).

One of the objectives of Healthy People 2020 (2018) is to reduce the prevalence of STIs by promoting healthy sexual behaviors. This goal can be accomplished by increasing access to services that will help to control STIs and prevent adverse health outcomes associated with these infections (Healthy People 2020, 2018). For HPV, the goal is to reduce the proportion of female adolescents who are infected with HPV (Healthy People 2020, 2018). In the United States alone, 14 million new cases of HPV are diagnosed each year, with approximately 50% of new cases occurring in persons 15 to 24 years of age (CDC, 2017). Reducing HPV infections is critical not only because HPV infection is the most common STI but also because HPV is linked to a high percentage of cervical, vaginal, vulvar, and oropharyngeal cancers in women (CDC, 2017).

Individual and Contextual Factors That Influence HPV Vaccination

Despite the effectiveness of the HPV vaccines, issues relevant to noncompletion of the series continue. Highlighted in this section are individual and contextual factors that influence completion of the vaccine series. These factors include age and gender, race and ethnicity, nativity, socioeconomic status, perceptions about the vaccine, health care providers' recommendation, access to health care, and factors relating to Hispanic individuals.

Age and Gender

Adolescents should receive the HPV vaccine series before they start engaging in sexual activity to prevent the spread of HPV and the development of genital warts and reduce the likelihood of developing HPV-related cancers (CDC, 2017). Currently, the HPV vaccines are recommended for adolescent girls 11 and 12 years of age, even though it can be administered to girls as young as 9 years of age (CDC, 2017). For girls and young female adults 13 to 26 years of age who were not vaccinated or have not completed the vaccine series within the specified time frame, the CDC (2017) recommended catch-up vaccines. However, because the vaccine targets young adolescent girls, the decision to vaccinate is at the discretion of the parents or, in most cases, the mothers (Fernandez et al., 2010).

Some researchers have found that when compared to girls 13 to 17 years of age, girls 11 and 12 years of age are less likely to complete the HPV vaccine series (Niccolai et al., 2011; Reiter, Katz, & Paskett, 2013; Schluterman, Terplan, Lydecker, & Tracy, 2011). Other researchers have not found any association between age and completion of the HPV vaccine series (Dorell et al., 2011; Verdenius et al., 2013; Widdice et al., 2011). After controlling for race, insurance, and region of residence, only Cook et al. (2010) found that older girls 17 years of age were less likely than girls 11 years of age to complete the HPV vaccine series. In another study, age was not consistently found to be a factor in completing the HPV vaccine series, but in general, younger girls 9 to 12 years of age were more likely than adolescents 13 to 17 years of age to comply with a multidose vaccine (Gallagher et al., 2016). What remains unclear is whether these inconsistent

findings are associated with the health-seeking behavior of adolescents or whether other factors are contributing to these differences (Gallagher et al., 2016).

Before 2011, boys were not included in the recommendation to receive the HPV vaccine; so most of what is known about the factors influencing completion of the HPV vaccine series has been gathered from studies on preadolescent and adolescent girls. Since the ACIP expanded its recommendation in 2011 to vaccinate boys routinely against HPV (Dunne et al., 2011), researchers have consistently demonstrated that boys have been less likely to initiate and complete the HPV vaccine series, irrespective of age, insurance status, socioeconomic status, health care usage, and health care center characteristics (Henry, Swiecki-Sikora, Stroup, Warner, & Kepka, 2018; Kepka, Ding, Hawkins, Warner, & Boucher, 2016; Moss et al., 2013). Using a national representative sample of male and female adolescents from the 2014 NIS-Teen, Reagan-Steiner et al. (2014), showed that of the male adolescents (41.7%) who initiated the vaccine series, only 21.6% completed it. Comparatively, 60% of the female initiated the vaccine series, but only 39.7% completed it (Reagan-Steiner et al., 2014). This trend has appeared to be specific to the HPV vaccine only because the vaccination rate for other adolescent vaccines has tended to be much higher (Brown et al., 2017; Reagan-Steiner et al., 2014). Even though the vaccine completion rate has been lower among male adolescents, completion rates for male and female adolescents remain well below the national standard of 80%. Hence, although it was not within the scope of this study, increasing the completion rate of the HPV vaccine series among male adolescents is as much a public health priority as it is for female adolescents.

Race and Ethnicity

Race and ethnicity are significant predictors of completion of the HPV vaccine series among adolescents (Niccolai et al., 2011). Compared to non-Hispanic Whites, Hispanic, African American, and American Indians adolescent girls have been less likely to complete the vaccine series (Elam-Evans et al., 2013; McKeever et al., 2015; Wilson, Brown, Carmody, & Fogarty, 2015). Using a nationally representative sample from the NIS-Teen, Elam-Evans et al. (2013) showed that HPV vaccine series completion rates for Hispanic and African American adolescents were consistently low during the 2010-2013 cycle. For female adolescents who initiated the vaccine series in 2013, Hispanics and African Americans were less likely than White girls of similar age to complete the series (Elam-Evans et al., 2013).

Moreover, these rates have tended to vary from state to state. States with a high percentage of adolescent girls from racial and ethnic minorities have tended to have lower completion rates (McKeever et al. 2015). For example, Mississippi has been found to have the lowest completion rate (19%) when compared to a 57.7% completion rate for Rhode Island (Dunne et al., 2014; Elam-Evans et al., 2013). Together, these findings suggest that there is either limited access to preventive services or underutilization of these services, even if they are accessible.

Country of Birth

According to the U.S. Census Bureau (2013), 4.1% of individuals 10 to 14 years of age and 7% of individuals 15 to 19 years of age living in the United States were born in other countries. Vaccination practices, access, availability, and schedules in other

countries might be different from those in the United States; therefore, vaccine coverage among foreign-born persons might be below U.S. national standards (Healy et al., 2018). Based on the literature, the country of birth can negatively affect vaccination coverage among young children (Varan et al., 2017) and adults (De & Budhwani, 2017; Lu, Rodriguez-Lainz, O'Halloran, Greby, & Williams, 2014; Pérez, Agénor, Gamarel, & Operario, 2018). For example, compared to U.S.-born infants less than 12 months of age, foreign-born infants have lower odds of being up to date on the routinely recommended vaccines for this age group (Varan et al., 2017). Likewise, compared to U.S.-born children 19 to 35 months of age, foreign-born children of similar ages are less likely to complete the combined vaccine series recommended for this group (Varan et al., 2017). The same trend also has been observed for adults, whereby foreign-born adults, compared to adults born in the United States, 18 to 32 years of age are less likely to initiate and complete the HPV vaccine series (De & Budhwani, 2017; Pérez et al., 2018).

Until recently, not much was known about the relationship between country of birth and vaccine coverage among adolescents. Unlike young children and adults, the results of a study by Healy et al. (2018) did not find any association between country of birth and coverage rate for the vaccines recommended for this group. Using data from the 2012-2014 NIS-Teen, Healey et al. found that coverage rates for the measles, mumps, and rubella vaccine (MMR); acellular pertussis vaccine; and meningococcal conjugate vaccine were comparable for foreign-born and American-born adolescents 13 to 17 years of age. Although foreign-born adolescents had a slightly lower coverage rate for hepatitis B vaccine, the coverage rate for hepatitis B was high for both groups (Healy et al., 2018).

However, for HPV and varicella, the vaccination coverage rate was low for both groups (Healy et al., 2018).

Among foreign-born girls, Healy et al. (2018) found that the unadjusted coverage rate for all doses of the HPV vaccine series was less than 38%; however, after adjusting for access to health care, socioeconomic factors, and demographic factors, such disparity no longer existed. This finding suggests that even though vaccine coverage rates are comparable for American-born and foreign-born adolescents, vaccination disparities still exist among this cohort. As highlighted in the Healy et al. study, socioeconomic and demographic disparities, as well as disparities in health care access, affect vaccine uptake, and as seen in this study, they do account for some of the differences seen in vaccine coverage among adolescents.

Perceptions of the HPV Vaccine

Maternal-Related Factors

Mothers' perceptions of the HPV vaccine are very influential to its uptake (Morales-Campos & Parra-Medina, 2017). For some mothers, it has been easier for them to justify accepting the vaccine because it prevents cancer (Morales-Campos & Parra-Medina, 2017; Roncancio et al., 2016, 2017). Some mothers have tended to believe that the vaccine is not necessary and that their daughters are too young to get the vaccine (Bastani et al., 2011; Laz et al., 2012). Other mothers have perceived that using the vaccine would promote sexual activity at a young age or promote high-risk sexual practices (Hendry, Lewis, Clements, Damery, & Wilkinson, 2013). However, based on the results of several studies, HPV vaccination is not associated with riskier sexual

behavior (Bednarczyk, Davis, Ault, Orenstein, & Omer, 2012; Liddon, Leichliter, & Markowitz, 2012; Mayhew et al., 2014).

The HPV vaccines are relatively new. Since their introduction, mothers have continuously voiced their concern about the safety of the vaccines (Berenson, 2015). These concerns have revolved around the side effects of the vaccines and any possible adverse effects that could affect the overall health and fertility of girls (Berenson, 2015; Schuler, Hanley, & Coyne-Beasley, 2014). Despite concerns about the safety of the vaccines, the vaccination of adolescent Hispanic girls is likely if the mothers believe that the vaccine prevents HPV infection and cervical cancer (Gold, Naleway, & Riedlinger, 2013; Roncancio et al., 2016). Based on perceived barriers and facilitators to getting the HPV vaccines, Hispanic mothers may or may not vaccinate their daughters against HPV (Roncancio et al., 2016). For example, availability of transportation, the ease of making appointments, and the ability to discuss the matter with health care providers can impact the chances of completing the vaccine series (Roncancio et al., 2016, 2017).

Maternal acceptability of the vaccine is one of the strongest predictors of adolescents not only accepting the vaccine but also actually getting the vaccine (Roncancio et al., 2016, 2017). Acceptability of the HPV vaccines is associated with maternal knowledge and awareness of HPV, HPV-related cancers, and the HPV vaccines (Morales-Campos & Parra-Medina, 2017). Several researchers have cited maternal lack of knowledge about HPV, the vaccine, and HPV-related outcomes as a barrier to vaccination (Dorell et al., 2011; Laz et al., 2012; Stokely et al., 2014). Likewise, although receipt of a recommendation from health care providers regarding HPV vaccination is

influential, some mothers view the lack of such recommendations as a sign that the vaccine must not be important (Laz et al., 2012; Stokely et al., 2014). Hence, without additional information about the vaccines and a recommendation from health care providers, adolescents are less likely to complete the vaccine series (Laz et al., 2012; Stokely et al., 2014).

Risk of HPV infection also has been cited as a barrier to vaccine uptake. Mothers who perceive that their children are not at risk of HPV infection or HPV-related cancers are less likely to have them vaccinated against the disease (Bastani et al., 2011; Laz et al., 2012). Conversely, Markovitz, Song, Paustian, and Reda (2014) found that mothers' use of preventive services like the Pap test is more predictive of their daughters receiving the HPV vaccines. This finding implies that mothers who are aware of HPV and HPV-related cancers and who themselves have taken steps to prevent cervical cancer can positively affect the HPV vaccination status of their daughters.

Adolescent Perceptions About the Vaccine

Most adolescents have a basic knowledge or understanding of HPV infection and the HPV vaccines (Valentino & Poronsky, 2016). However, depending on where they get their information, they might be misinformed about HPV infection and the vaccines (Berenson, 2015). One study in Texas by Morales-Campos et al. (2013) found that among girls 14 to 17 years of age, many did not know about cervical cancer, what caused it, how it could be prevented, or who was at risk of developing it. For adolescents who are misinformed, what they know about HPV and the vaccines can negatively affect their overall attitude toward them (Forster, Marlow, Wardle, Stephenson, & Waller, 2010;

Rambout, Tashkandi, Hopkins, & Tricco, 2014). Some adolescents believe that the vaccines are neither necessary nor effective (Forster et al., 2010; Rambout et al., 2014). Still, others believe that because they are not sexually active, are married, or are in monogamous relationships, the vaccine is not needed (Liddon et al., 2012: Zimet, Weiss, Rosenthal, Good, & Vichnin, 2010).

When adolescent girls value the opinions of their mothers, they are more likely to mirror the attitudes and opinions of their mothers (Mullins et al., 2013). In such cases, if the mothers do not agree with the HPV vaccine, the daughters also are less likely to comply with the three-dose vaccine regiment (Mullins et al., 2013). Adolescents are, however, more likely to complete the vaccine series if they perceive that they are at risk of HPV infection and cancer and are susceptible to STIs (Kessels et al., 2012). They are also more likely to complete the vaccine series if they perceive HPV as severe and believe that the vaccine is protective against HPV or can prevent cancer (Morales-Campos et al., 2013).

Provider Recommendation

Of the factors most often associated with the uptake of the HPV vaccine series, receipt of a recommendation from health care providers is the strongest predictor of being vaccinated against HPV (Brewer et al., 2011; Gilkey et al., 2015, 2016; Holman et al., 2014; Lau, Lin, & Flores, 2012; Reiter, McRee et al., 2013). Receipt of a recommendation from health care providers to vaccinate against HPV is so instrumental that 70% of the recipients of such a recommendation have initiated the vaccine series (Dorell et al., 2010). Using a national online survey, Gilkey et al. (2016) found that 75%

of the study participants who received a recommendation from their health care providers initiated the vaccine series and about 43% of them completed the vaccine series.

Despite the impact of health care providers' recommendation regarding uptake of the HPV vaccine, not all adolescent girls receive a recommendation from their health care providers (Gilkey et al., 2015, 2016). Girls from racial and ethnic minorities, particularly Hispanic and African American girls, are less likely to receive a recommendation to get the HPV vaccine from their health care providers (Morales-Campos et al., 2013). Girls living below the federal poverty level are also less likely to receive such a recommendation (Niccolai et al., 2011). If they have received a recommendation from their health care providers, analysis of data from the NIS-Teen 2009 survey showed that Hispanics and African Americans were as likely as their White age mates to get the vaccine (Ylitalo, Lee, & Mehta, 2013).

Among African American and Hispanic adolescents, the lack of a recommendation from health care providers to get the HPV vaccine might be associated with not having regular medical homes, being uninsured, and using preventive care services irregularly, even if they are accessible (Holman et al., 2014). The lack of a recommendation by health care providers among ethnic minorities might be exacerbated by factors inherent to their status as immigrants (if applicable); among these factors are low health literacy, language barriers, low levels of acculturation, and so on (Jeudin et al., 2014). Gerend et al. (2013) found that the odds of receiving a recommendation to get the HPV vaccine series were higher among individuals who were more acculturated than among individuals who were less acculturated.

Although the emphasis of health care providers' recommendation is reflected more in the percentage of persons who start the HPV vaccine series, such a recommendation is equally important to complete the HPV vaccine series (Kepka et al., 2015). Health care providers also should stress the importance of completing the vaccine series to be protected fully against HPV (Berenson, 2015). The providers should inform parents and adolescents that they have to return for the second and third doses (Berenson, 2015). This oversight was made evident by a study that evaluated the HPV knowledge of Hispanics in Utah (Kepka, Ulrich, & Coronado, 2012). The results of this study revealed that among the survey participants, most parents were not aware that the HPV vaccine is a multidose vaccine (Kepka, Ulrich, & Coronado, 2012). By highlighting the importance of initiating as well as completing the vaccine series, health care providers can drastically boost the level of HPV vaccine completion among adolescents, especially among adolescent girls from racial and ethnic minority groups.

Financial Barriers

Cost of the Vaccine

The HPV vaccine is one of the most expensive vaccines to date. In U.S. dollars, the cost per dose, if using the 4vHPV, ranges from $121 to $160 (CDC, 2015b). If the 9vHPV is received, the cost ranges from $168 to $204 per dose (CDC, 2018). In total, completing either the 4vHPV or the 9vHPV series can cost from $363 to $480 or $504 to $612, respectively (CDC, 2015b, 2018). The difference in price is based on whether the vaccine is covered or not covered by public or private insurance. The lower prices are for

Medicaid or Vaccination for Children (VFC) recipients, and the higher prices are for those with private insurance or who are paying out of pocket (CDC, 2018).

For parents, the cost of the vaccine can be burdensome. Not every adolescent is eligible for Medicaid, and not everyone can afford private insurance or pay for the vaccine out of pocket (Bruno, Wilson, Gany, & Aragones, 2014; Warner et al., 2015). Likewise, not everyone qualifies for the VFC program, which provides the vaccine at no cost to eligible recipients (CDC, 2016d). Furthermore, even if the children qualify for VFC, some parents might not know about this program (Reiter, Katz, & Paskett, 2013). Persons without insurance coverage might struggle to pay the high cost of the vaccine or might even choose not to get it because they might view it as a nonurgent medical matter (Nordin, Solberg, & Parker, 2010).

Health Care Providers' Administrative Fees

From the perspective of health care providers, it is difficult for doctors to store and administer the vaccine to their patients (Quinn, Murphy, Malo, Christie, & Vadaparampil, 2012). In their private practices, doctors pay for and stock the vaccine so that it is readily available to administer to patients. In addition to paying for the vaccines themselves, doctors absorb the cost of storing and administering the vaccine. Although they keep the vaccine in stock as a service to their patients, they stand to lose or gain very little from doing so because they are reimbursed poorly for this service (Gable, Eder, Noonan, & Feemser, 2016). Without incentives, health care providers might be less inclined to offer such services or recommend the vaccine to persons who are either underinsured or uninsured (Pourat & Jones, 2012; Ylitalo et al., 2013). Because girls

from racial and ethnic minority groups are more likely to be underinsured or uninsured, they are less likely to receive a recommendation for the HPV vaccination from their health care providers.

Socioeconomic Status

Low socioeconomic status, that is, lower disposable income and lower education, highly correlates with the incidence of cervical cancer in the United States (González et al., 2015). However, relative to the HPV vaccine, very few studies in the United States have captured the ways that socioeconomic factors affect the uptake of the vaccine series among adolescent girls. Results of these few studies have either been insignificant or conflicting, indicating that HPV vaccination uptake was less likely among individuals living below the poverty level (Fisher, Trotter, Audrey, MacDonald-Wallis, & Hickman, 2013; Roberts et al., 2010) or was not associated with low income (Pruitt & Schootman, 2010).

Family income. Polonijo and Carpiano (2013) analyzed data from the 2008-2010 NIS-Teen to assess social inequalities associated with vaccinating adolescents against HPV. Based on their analysis, yearly estimates of household income from 2008 to 2010 were inconsistently associated with completion of the vaccine series. Likewise, the odds of completing the vaccine series were significantly lower (23%-25%) for girls from low- and middle-income households than for girls from higher-income households (Polonijo & Carpiano, 2013). However, multivariate analyses from other studies showed that parental income (Gold et al., 2013; Laz et al., 2010); neighborhood income; and household income (Markowitz et al., 2014) were not associated with completion of the HPV vaccine

series.

Results of a study conducted in Denmark by Slåttelid Schreiber, Juul, Dehlendorff, and Kjaer (2015) showed that despite having free access to the HPV vaccine, adolescent girls from ethnic minority groups were less likely to initiate and complete the vaccine series. Compared to Danish adolescent girls from households with parents having more disposable income, adolescent girls whose parents had less disposable income were less likely to initiate and complete the vaccine series (Slåttelid Schreiber et al., 2015). Likewise, compared to Danish girls whose mothers were married and employed, girls whose mothers were unmarried and unemployed tended to have lower odds of initiating and completing the vaccine series (Slåttelid Schreiber et al., 2015).

Another study conducted in Norway (B. T. Hansen, Campbell, Burger, & Nygard, 2015) did not find an association between socioeconomic factors and completion of the vaccine series. In this study, B. T. Hansen et al. (2015) noted that initiation of the vaccine series correlated with parental ages and incomes, receipt of the MMR vaccine, and maternal occupations. However, only receipt of the MMR vaccine correlated with completing the HPV vaccine series; socioeconomic factors did not have any effect on completion rate (B. T. Hansen et al., 2015). If the girls did not receive the MMR vaccine, their chances of completing the HPV vaccine series was considerably lower than if they had been vaccinated (B. T. Hansen et al., 2015).

Maternal education. Polonijo and Carpiano (2013) identified an association between maternal education and completion of the vaccine series varies. They concluded

that as the level of maternal education decreased, the odds of completing the HPV vaccine series were 11% to 28% lower for uneducated versus college-educated mothers. Multivariate analyses from another study showed that the level of parental education was not associated with completion of the HPV vaccine series (Fisher et al., 2013).

The study conducted by Slåttelid Schreiber et al. (2015) showed that despite having free access to the HPV vaccine, adolescent girls from ethnic minorities were less likely to initiate and complete the vaccine series. Compared to Danish adolescent girls from households with parents having higher levels of education, adolescent girls whose parents were less educated were less likely to initiate and complete the vaccine series (Slåttelid Schreiber et al., 2015). However, B. T. Hansen et al. (2015) did not find any association between education and completion of the HPV vaccine series. B. T. Hansen et al. concluded that even though initiation of the vaccine series correlated with parents' educational attainment, receipt of the MMR vaccine, and maternal occupation, only receipt of the MMR vaccine correlated with completing the HPV vaccine series. Thus, they argued that socioeconomic factors did not have any effect on completion of the vaccine series. It was more likely that if the girls did not receive the MMR vaccine, they were less likely to complete the HPV vaccine series (B. T. Hansen et al., 2015).

Hispanics and the Risk of HPV

Hispanic Health

Hispanics are the fastest growing and the largest ethnic group in the United States. Currently, the Hispanic population accounts for 17.6% (56.5 million) of the U.S. population and comprises Mexicans (66%), individuals from South and Central America

(13%), Puerto Ricans (9.5%), Cubans (4%), and other Hispanics (7.5%; Pew Research Center, 2017; U.S. Census Bureau, 2013). Hispanics under the age of 18 years account for approximately 17% of the U.S. population of children, and this percentage is expected to increase to 28.6% by 2060 (Colby & Ortman, 2014).

Hispanics are an exceptional class of immigrants. Although they are disadvantaged socioeconomically, their overall health is better than that of African Americans and non-Hispanic Whites (Camacho-Rivera, Kawachi, Bennett, & Subramanian, 2015). This health advantage has been associated with some sociocultural factors that are protective against unhealthy behaviors (Lam, Goldenson, Burner, & Unger, 2016). These factors include family, religion, and cultural or traditional beliefs and practices that promote certain behaviors that are not destructive to one's overall well-being (Johnson-Motoyama, 2014; Lam et al., 2016). However, the longer that Hispanic individuals reside in the United States, the more they are exposed to behaviors that ultimately cause them to lose their health advantage (Camacho-Rivera et al., 2015; Ro, 2014).

Deterioration in the health of Hispanics has been partially attributed to social and structural factors that shape the conditions in which they live (Velasco-Mondragon et al., 2016). Among these factors are lower levels of education, lack of access to health care services, lower socioeconomic status, underinsured or uninsured status, and low-paying jobs (Velasco-Mondragon et al., 2016). These challenges are further compounded by federal and state policies and practices that restrict their access to health services and social programs (Johnson-Motoyama, 2014). It has been estimated that more than 80% of

Hispanic children (i.e., < 18 years of age) born in the United States are the children of unauthorized immigrant parents (Passel & Cohn, 2011). As U.S. citizens, these children would naturally qualify for most programs, but because of laws and policies that affect their parents negatively, they cannot participate in such programs (Johnson-Motoyama, 2014; Seiber, 2013). This fact is important to note because it offers some explanation for the high percentage of Hispanic children and adolescents who are underinsured or uninsured and why they access preventive care services sporadically, if at all (Schmeer, 2012).

HPV Among Hispanics

In the United States, Hispanic women have the highest incidence of cervical cancer (ACS, 2017; Kepka et al., 2015). They are 2 to 3 times more likely to develop cervical cancer because of persistent infection with genital HPV and are less likely to have had a Pap test (ACS, 2017; Lechuga et al., 2016). Compared to non-Hispanic White women, the incidence of cervical cancer among Hispanic women is 74% higher, and the mortality rate among this group of women is 48% higher (ACS, 2017). Each year, approximately 2,000 Hispanic women are diagnosed with cervical cancer, and approximately 600 of them die from the disease (ACS, 2017). Given the incidence of cervical cancer among Hispanic women, HPV vaccination might be of great importance to this group of women. Researchers have shown that even though Hispanic adolescent girls are more likely to initiate the HPV vaccine series, they are less likely than non-Hispanic White adolescent girls to complete the three-dose series (Jemal et al., 2013; Niccolai et al., 2011; Polonijo & Carpiano, 2013). Over time, if this pattern of vaccine

coverage persists among Hispanic girls, the gap in HPV-related disparities for this group of women is likely to widen (Roncancio et al., 2017).

Acculturation, Health Literacy, Social Influence, and HPV Vaccination

Relative to Hispanics and the reduction of their risk of HPV infection, acculturation might not only be a barrier but also a facilitator of their being vaccinated (Gerend et al., 2013; Held & Cuellar, 2016; Kepka et al., 2015). Acculturation refers to a sociocultural process through which individuals from a cultural group adapt to the culture of the host country as a result of exposure to its values, beliefs, attitudes, behaviors, and customs (Lopez-Class, Castro, & Ramirez, 2011; Ward & Geeraert, 2016). Individuals vary in their level of acculturation, and based on their level of acculturation, they might or might not be at a disadvantage for poor health outcome (Lopez-Class et al., 2011; Ward & Geeraert, 2016). For example, individuals who are more acculturated are more likely than individuals who are less acculturated to receive a recommendation for HPV vaccination from their physicians (Gerend et al., 2013). Conversely, a high level of acculturation is associated with adopting behaviors such as engaging in risky sexual practices that increase the risk of HPV, as suggested by Kepka, Coronado, Rodriguez, and Thompson (2010). Analysis of data from the 2003-2004 National Health and Nutrition Examination Survey indicated that Mexican American women who were more acculturated than women who were less acculturated were more likely to be infected with high-risk HPV serotypes (Kepka et al., 2010).

Although researchers have contended that acculturation has a positive effect on disease prevention (Breen, Rao, & Meissner, 2010; Lebrun, 2012), how it correlates with

completing the HPV vaccine series remains unclear. Some researchers have reported not finding an association between acculturation and initiation of or intention to initiate the HPV vaccine series (Guerry et al., 2011; Luque et al., 2010). In other studies, acculturation has been reported as a barrier to the uptake of the HPV vaccine (Walter et al., 2017) and that acculturation has contributed to the racial and ethnic disparities associated with the uptake of the HPV vaccine (Wisk et al., 2014). However, Gerend et al. (2013) found that acculturation was associated with the uptake of the HPV vaccine, meaning that more acculturated mothers were more likely than mothers who were less acculturated to have their children vaccinated against HPV.

Individuals who are less acculturated tend to have limited health literacy, which impedes their ability to make health-related decisions and to follow certain health-related directives (Ciampa et al., 2012). As such, Hispanics or Spanish speakers are at a higher risk of experiencing problems related to health literacy (R. Singh, Coyne, & Wallace, 2015). Besides having variations in HPV-related knowledge, having limited health literacy also might prevent Hispanics from accessing better HPV-related information and then processing such information to help them to make more informed decisions about receiving the vaccine (Baldwin, Bruce, & Tiro, 2013). HPV literacy among Hispanic mothers is associated with a higher chance of their daughters being vaccinated against HPV, thus reducing the children's risk of infection (Beltran, Simms, Lee, & Kwon, 2015; Wisk et al., 2014). Hispanic mothers with low literacy have lower odds of vaccinating their daughters against HPV, thus increasing their daughters' risk of HPV infection (Beltran et al., 2015; Wisk et al., 2014). The same is true of mothers who are unaware of

or have limited knowledge of HPV, the vaccine, and HPV-related diseases (Beltran et al., 2015; Wisk et al., 2014).

The literature has shown that immigration disrupts the social networks of Hispanic immigrants. Compared to U.S.-born Hispanics, foreign-born Hispanics tend to have lower social support, meaning that they will have fewer sources at their disposal to assist them in making health-related decisions (Allen et al., 2014). For Hispanics, the family is highly valued and is integral to the decision-making process. The nursing theory-health promotion model posits that people are more likely to obtain health information from peers, friends, and family members, and are subsequently more likely to engage in health behaviors that positively affect their health when people in the social circle model the behaviors and show their support to enable the behaviors (Nursing Theory, 2016). Therefore, for immigrants who are socially connected, having other people who model or support certain health-related behaviors (e.g., vaccinating against HPV) reflects the likelihood of engaging in such behaviors. If they know someone who has completed the vaccine series or has cervical cancer, Hispanic mothers are more likely to vaccinate their daughters against HPV (Morales-Campos et al., 2013; Stephens, Tamir, & Thomas, 2016). Likewise, adolescent girls are more likely to get the vaccine if they know that their friend(s) have gotten the vaccine. Likewise, the negative experiences of others, their negative attitudes toward health care providers, and the type of information relayed about HPV and the HPV vaccine can adversely affect the decision to be vaccinated (Stockwell, Irigoyen, Martinez, & Findley, 2011).

Because newly immigrated Hispanic mothers might not have the resources (e.g., health insurance or access to health information) to maintain the health of their families, it is important for them to be socially connected (W. Kim, Kreps, & Shin, 2015). Being acculturated and socially connected are important because interacting with others will serve as a source of information (e.g., affordable services, the location of clinics, etc.). In addition, by interacting with other mothers, they will learn about the health-related norms of the host country (W. Kim et al., 2015). Mothers who associate with others who have accepted the HPV vaccine are more likely to ensure that their children receive the vaccine as recommended. For mothers who are unacculturated or who are not health literate, people in their social networks can be a source of information, and they can help the mothers to find the necessary information and resources (Y. C. Kim, Lim, & Parks, 2015).

Access to Health Care and HPV Vaccination

Receiving a health care provider recommendation for HPV vaccination and having regular preventive care visits are critical to the uptake of the HPV vaccines. Adolescent girls from racial and ethnic minority groups and girls from families with lower socioeconomic status are more susceptible to having limited access to preventive care services and receiving poorer quality of care (Gelman et al., 2013; Polonijo & Carpiano, 2013). Hispanics are distinctly at a disadvantage in terms of receiving quality and appropriate care to meet their needs. Whether seeking to address medical issues or use preventive services, Hispanics in the United States have limited access to health services and are less likely to have primary medical homes. They also are less likely than

other racial and ethnic groups to use preventive care services (Gelman et al., 2013; Velasco-Mondragon et al., 2016). Because health care providers are needed to administer the vaccine, adolescents from racial/ethnic minority groups who have limited or no access to preventive care services will continue to be underimmunized (Gelman et al., 2013).

Even if their primary health care providers are accessible, many U.S. adolescents do not see them for the recommended annual well-care visit (Bruno et al., 2014). Based on a survey of physicians servicing racial/ethnic minority communities, about 70% of these doctors reported that a limiting factor for receiving a recommendation for the HPV vaccine was the lack of preventive care visits by eligible adolescents (Bruno et al., 2014). Even with insurance coverage, Tsai, Zhou, Wortley, Shefer, and Stokley (2014) commented that among adolescents who are privately insured, approximately 43% of them had made at least one preventive care visit at the time of the study. Relative to the HPV vaccine, this fact is concerning because preventive care visits are the ideal situations for health care providers to recommend and administer the vaccine (Berenson, 2015).

Dorell et al. (2011) reported that after controlling for sources of information and health care utilization, adolescent girls and young adult females were more likely to receive the HPV vaccine series if they had made recent health care visits and had discussed getting vaccinated with their health care providers. Preventive care usage also varies by U.S. state (Moss, Reiter, & Brewer, 2015). For girls living in states with high percentages of preventive care service usage, Moss et al. (2015) found that the likelihood of completing the HPV vaccine series was higher among these girls than among girls

living in states with lower percentages of preventive care usage. These findings suggest that interactions with health care providers and residence in areas where the use of preventive care services is high influence the likelihood of being vaccinated.

Having primary medical homes is crucial. Test, Caskey, and Rankin (2013) evaluated the relationship between receiving the HPV vaccine series and having permanent medical homes. They concluded that girls with permanent medical homes were more likely than girls without permanent medical homes to get the vaccine. This finding suggests that having permanent medical homes is influential in the uptake of the vaccine. In another study (Perreira et al., 2012), Hispanics were found to be less likely to have permanent medical homes and turned, instead, to hospitals, community health centers, public clinics, or school-based health centers to meet their health care needs. By using these different facilities, some parents might not recognize the need to establish permanent medical homes (Banspach et al., 2016; Nordin et al., 2010).

From a public health perspective, these facilities are attractive because they can serve as points of contact to help in delivering the HPV vaccine to ensure that girls can either initiate or complete the vaccine series (Guleria, Jones, Zimmerman, Stempinski, & Patel, 2016). Besides being points of care for delivering the vaccine, these sites have the potential to help to address such issues as differences in language and literacy levels that impact the patient-provider relationship (Javier, Festa, Florendo, & Mendoza, 2015). They also might help to address barriers specific to the health care system, such as geographic availability and staff competency (Javier et al., 2015). Using different facility types to obtain health care services does not eliminate the need to establish primary

medical homes, but they do have the potential to help to reduce disparities in access to health care services. The role that they play in delivering the HPV vaccine might also offer further insight into differences seen in the uptake of the HPV vaccine among adolescents.

Insurance Coverage and HPV Vaccination

The most cited reasons for not accessing health care services are either the lack of health insurance or inadequate insurance (G. K. Singh et al., 2013). The HPV vaccine series is costly (Lu et al., 2018), so without coverage by private insurance or Medicaid, it might be a struggle for some parents to pay for it out of pocket. Children of immigrant parents have lower health insurance coverage than children of U.S.-citizens (Jarlenski et al., 2016). Compared to other racial and ethnic minority groups, Hispanics tend to have the highest percentage of uninsured children and adolescents (Berdahl, Friedman, McCormick, & Simpson, 2013; G. K. Singh et al., 2013). Likewise, most people living below the poverty level are either African American or Hispanic, so from this perspective, African Americans also are likely to have a high percentage of uninsured children (Jeudin et al., 2014).

Being underinsured or uninsured does affect the likelihood of being vaccinated against HPV. In general, researchers have determined that private insurance holders have higher odds of completing the vaccine series than individuals who are either uninsured or are covered by public insurance (Dorrell et al., 2011; Harper et al., 2014; Widdice et al., 2011). Researchers analyzing data from the NIS-Teen have found that vaccine initiation and completion were the lowest among adolescent girls who were not insured (Reiter,

Katz, et al., 2013; Reiter et al., 2014). What was striking about this finding is that these girls qualified for free vaccines under the VFC Program, but whether they even knew about the program or their eligibility was unclear (Reiter et al., 2014).

Eligibility and free HPV vaccination do not necessarily mean that the rate of completing the vaccine series will increase (Harper et al., 2014). In a retrospective cohort study, Harper et al. (2014) found that providing the HPV vaccine at no cost did not significantly influence completion of the vaccine series; in fact, none of the recipients of the free vaccine completed the series. This finding suggests that other factors might have been contributing to this outcome.

Whether privately or publicly insured, continuity in coverage or maintenance of coverage is critical to receipt of the vaccine (Rand & Goldstein, 2018). Based on the literature, insurance coverage is normally assessed at a single point in time, usually at the time of the medical visit or when the survey is administered. However, in doing so, researchers have failed to capture periods when persons were uninsured resulting from discontinuity in coverage (Cowburn et al., 2014; DeVoe et al., 2015). For vaccines that are administered in a single does, discontinuity or gaps in insurance coverage might not be as worrisome, but for multidose vaccines like the HPV vaccine series, this gap can be problematic (Cowburn et al., 2014). As recommended, the HPV vaccine is administered over 6 months, that is, at baseline (0 months), 2 months, and 6 months. However, not everyone adheres to this schedule, so some individuals might need more than 6 months to complete the series. During this time, insurance coverage status might change, thus affecting the likelihood of completing the vaccine series (Cowburn et al., 2014). When

insurance status is measured at a single point in time, it is difficult to assess the ways that discontinuity in coverage might influence the uptake of multidose vaccines like the HPV vaccine series (Cowburn et al., 2014).

Discontinuity in insurance coverage or gaps in insurance coverage might be as problematic as being uninsured. Discontinuity in coverage has been associated with limited or inconsistent use of preventive services, unmet medical needs, and the inability to fill prescriptions (DeVoe et al., 2015; Guevara et al., 2014; Wisk & Witt, 2012). Based on the literature, being Hispanic adolescents 10 to 18 years of age from families with incomes below the federal poverty level predicts whether or not the children are likely to experience gaps in insurance coverage (DeVoe et al., 2015; Fairbrother et al., 2011). Similarly, being adolescents in families where only one parent is employed also predicts whether the children are continuously insured, or not (DeVoe et al., 2015). For employer-provided insurance, the parents might not be able to afford family coverage, so the children of these parents might not have any coverage for an extended period (DeVoe et al., 2011). Similarly, for individuals who rely on employer-provided health insurance, changes in parental employment status can lead to changes in coverage or even the loss of coverage (Smits-Seemann et al., 2016).

Regarding vaccinations, being insured continuously should not matter for children less than 18 years of age. This is because children who are uninsured, underinsured, or eligible for Medicaid can still get vaccines at no cost through the VFC Program (CDC, 2016d). However, DeVoe et al. (2015) and Yamauchi, Carlson, Wright, Angier, and DeVoe (2013) noted that parental insurance status does affect the insurance status of the

children, that is, continued parental coverage increases the likelihood of the children maintaining coverage. This finding suggests that disrupting parental insurance coverage, whether private or public, is likely to affect the children's coverage.

Cowburn et al. (2014) specifically looked at insurance continuity and HPV vaccine uptake in two states and found that for adolescents 13 to 17 years of age, insurance continuity did matter. Analysis of data from federally qualified health centers in the two states showed that adolescents 13 to 17 years of age were significantly less likely to initiate the HPV vaccine series if they were not insured continuously. However, in their study, Cowburn et al. stated that insurance coverage did not significantly predict the likelihood of completing the vaccine series. One shortcoming of the study was that Cowburn et al. were limited to using electronic health records specific to these centers, meaning that they could not assess how the data compared to the data of existing vaccine registries.

It also was possible that different categories of insurance coverage affected uptake of the HPV vaccine series or that the disruption in insurance coverage or no coverage at all was underestimated by Cowburn et al. (2014). Taken together, disparities in vaccine relative to insurance status could have been attributed to the underreporting of vaccination status, thus limiting the findings of their study. Overall, gaps in insurance coverage are not uncommon and should be taken into consideration when assessing insurance coverage and the completion of multidose vaccines.

Summary

Completing the HPV vaccine series is important to all adolescents. However, it is more important for Hispanic adolescent girls to complete the series, given that Hispanic women have the highest incidence of cervical cancer. Despite the availability and effectiveness of the HPV vaccine, completion of the series remains low among adolescent Hispanic girls. Although Hispanic adolescent girls are more likely than non-Hispanic White girls to initiate the vaccine series, they are less likely to complete it for a variety of reasons, including having limited access to health care and being underinsured or uninsured. Because Hispanic adolescents are less likely to have permanent medical homes, they also are less likely to have at least one annual well-care visit, and they are more likely to have their health care needs met at other facilities, making it unlikely that they will receive the vaccine during these visits. To maximize uptake of the HPV vaccine series, it should be offered at all visits, irrespective of where the visits occur.

Similarly, insurance status also can impact access to the vaccine. To be specific, continuity in insurance coverage is crucial to adolescent health. For adolescents, obtaining and maintaining health insurance coverage is determined by their parents' insurance status. Parental insurance coverage decreases the likelihood of gaps in insurance coverage for the children. Being insured continuously means sustained access to preventive services and stability of care (i.e., multiple visits to complete the vaccine series).

Despite evidence supporting the effectiveness of the HPV vaccine series, the limited uptake of the vaccine among the high-risk population remains a concern. To

address disparities in HPV vaccine coverage and HPV-related disparities among Hispanic women, efforts to increase uptake of the HPV vaccine series among this population are needed. Guided by this review of the literature, the current study helped to fill a gap in the literature by assessing the ways that the source of health care and continuity in insurance coverage influenced completion of the HPV vaccine series among Hispanic girls. Analyzing the role of different sources of health care on the uptake of the HPV vaccine helped to clarify whether using the facilities in question would facilitate greater uptake of the vaccine among Hispanic adolescents. To address issues regarding health insurance coverage, it was important to know whether lapses in insurance coverage would affect the likelihood of completing the HPV vaccine series.

Insurance coverage or gaps in insurance coverage and the source of health care accessed had not been assessed quantitatively in relation to completion of the HPV vaccine series among Hispanic adolescent girls. Therefore, the purpose of this study was to determine if insurance coverage, more specially, gaps in insurance coverage and the type of medical facility accessed for health care, correlated with low rates of HPV vaccine series completion among Hispanic adolescent girls. In Chapter 3, I present the research design and discuss the methodology of the study.

Chapter 3: Research Method

Introduction

Hispanic adolescent girls are less likely to complete the HPV vaccine series (Kepka et al., 2015; Roncancio et al., 2017; Walker et al., 2017). Losing insurance coverage, even for a short time, can have a negative impact on the likelihood of continued care and preventive service usage (DeVoe et al., 2015). Based on the literature reviewed, adolescents from racial and ethnic minority groups are more likely to experience lapse in insurance coverage for extended periods (DeVoe et al., 2015; Gelman et al., 2013). Prior to this study, the extent to which insurance coverage gaps affect uptake of the HPV vaccine series had not been explored fully (Cowburn et al., 2013; Lu et al., 2018). Using provider-verified HPV vaccine data from a nationally representative sample of Hispanic adolescent girls, I assessed the extent to which discontinuity in insurance coverage influenced completion of the HPV vaccine series in this study. I also assessed the ways that gaps in insurance coverage affected Hispanic girls' access to their primary care provider for HPV vaccination. The dependent variable in the study was HPV vaccination status (i.e., being vaccinated or not vaccinated), and the independent variables were insurance coverage (i.e., insurance status of the adolescent) and the type of medical facility used to access health care. Covariates included maternal age, family income, maternal education, and health care provider recommendations.

The purpose of this chapter is to present the study design, methodology, and data analysis plan that I used to assess the relationship between insurance coverage, type of medical facility used to access health care, and uptake of the HPV vaccine series. In this

chapter, I also discuss the target population of interest and the sample size. Because I analyzed secondary data from the 2016 NIS-Teen were analyzed, I include an explanation of the original data collection instrument and protocol. In this chapter, I also explain the ethical procedures relevant to collecting and storing the data, operationalization of the variables of interest, and relevant threats to the validity of the study.

Research Design and Rationale

In this study, I used a quantitative, cross-sectional design to assess the relationship between insurance coverage, source of health care, and completion of the HPV vaccine series. A cross-sectional research design was appropriate for this study to determine if there was a relationship between insurance coverage, type of medical facility used to access health care, and completion of the HPV vaccine series because with this design, it was possible to assess the nature of the relationship between two or more variables (i.e., if changes in one or more of the independent variables was related to changes in the dependent variable; Setia, 2016). Cross-sectional studies allow researchers to assess the strength and direction of relationships (Setia, 2016; Thiese, 2014). The cross-sectional research design allows researchers to measure the exposure and outcome within the sample simultaneously (Setia, 2016; Thiese, 2014). Although the cross-sectional research design allows researchers to assess the association between exposure and outcome, it does not allow researchers to establish any cause and effect between and among variables (Setia, 2016; Thiese, 2014). For example, if a relationship between insurance coverage

and HPV vaccination status had been found, it would not have been possible to conclude that a lack of insurance coverage was the reason for not being vaccinated against HPV.

Methodology

In this section, I explain how the study was conducted and provide information about the target population, the sample size, and the sampling technique. In this section, I discussed how the variables of interest were operationalized, the instrument used to collect the data, and the data analysis plan. In this section, I also discussed threats to validity of the study and the ethical considerations that are applicable to the study.

Target Population

The target population comprised of Hispanic adolescent girls 13 to 17 years of age. Approximately 17% of the U.S. populations of children who are younger than 18 years of age are Hispanic (Colby & Ortman, 2014). Of this percentage of Hispanic children, national data have suggested that more than 70% of them have been and remain underinsured or uninsured (Gelman et al., 2013; Polonijo & Carpiano, 2013), a situation that has made them more susceptible to having limited access to preventive care services.

Sampling and Sampling Procedure

In this study, I used secondary data from the 2016 NIS-Teen (CDC, 2016a). As an adjunct to the NIS-Child, the NIS-Teen is administered to monitor vaccine coverage among adolescents 13 to 17 years of age (CDC, 2016a). The NIS-Child is conducted annually and targets households in the United States and select territories with children 19 to 35 months of age (CDC, 2016a). Initially, the households are screened for the presence of children 19 to 35 months of age and are administered the NIS-Child (CDC,

2016a). These households are then screened for the presence of adolescents 13 to 17 years of age (CDC, 2016a). If adolescents are present in these households, the parents or guardians who are the most informed about the adolescents' vaccination histories are interviewed (CDC, 2016a). In households with more than one adolescent, one adolescent between 13 and 17 years of age is randomly chosen to be the subject of the interview (CDC, 2016a). Household interviews for the 2016 NIS-Teen began on January 14, 2016, and ended on February 9, 2017, with data being collected from health care providers from February 2016 to March 2017 (CDC, 2016a). The 2016 NIS-Teen targeted adolescents born between January 1998 and February 2004, and only participants living in the United States and select U.S. territories and who were not institutionalized at the time of the survey were interviewed (CDC, 2016a).

The survey was administered in two phases using random digital dialing (CDC, 2016a). The first phase, the household telephone survey, was administered to respondents whose telephone numbers were selected randomly from a list of landline and cell phone numbers (CDC, 2016a). For landline numbers, the telephone survey used quarterly samples of telephone numbers (CDC, 2016a). Each quarter, the sample of telephone numbers is updated to reflect new telephone numbers and area codes (CDC, 2016a). For the cell phone numbers, the respondents were selected randomly from all banks of cell phone numbers (CDC, 2016a). Each quarter, landline and cell phone numbers are sampled within estimation areas (CDC, 2016a). For the 2016 administration of the survey, 61 estimation areas were listed by state or territory (CDC, 2016a).

Based on this design, each cycle of the survey was estimated to have a specific degree of precision, meaning that a combination of landline telephone and cell phone respondents would yield a target of 6.5% coefficient of variation (CDC, 2016a). To achieve this level of precision, statistical modeling was used to predict the number of sample telephone numbers (i.e., landline and cell phone numbers) needed to meet this target (CDC, 2016a). Preliminary analysis of the unweighted 2016 NIS-Teen data files showed that more than 13 million telephone numbers were screened, and from that number, 44,771 households with age-eligible adolescents completed the household interviews (CDC, 2016a). This number included samples from the landline telephone (n = 9,502) and cell phone (n = 35,269) interviews (CDC, 2016a). The 2016 NIS-Teen public use file that I used in this study comprised data from 43,071 households, excluding participants from Guam and the U.S. Virgin Islands (CDC, 2016a).

The second phase of the survey involved checking vaccination records with the respective providers (CDC, 2016a). During the interviews, the parents of the eligible children were asked to provide the names of the health care providers who administered the HPV vaccine series to their children (CDC, 2016a). They also were asked for permission to contact those providers (CDC, 2016a). Once this permission was received from the respondents, the health care providers were invited to complete immunization history questionnaires to verify the vaccination information provided by the respondents (CDC, 2016a). A preview of the data indicated that 33,389 health care providers completed and returned the immunization history questionnaires and that 20,475 of these

questionnaires provided adequate vaccine histories relative to the adolescents of interest (CDC, 2016a).

Sample Size and Power

I used G*power 3.1 (Faul, Erdfelder, Lang, & Buchner, 2013) to calculate the power needed to detect the likelihood of a statistically significant relationship between insurance coverage, the type of medical facility used to access health care, and completion of the HPV vaccine series, if such significance was present. For this analysis, a compromise power analysis was used; this analysis facilitated calculating the power and implied alpha, given the sample size, beta/alpha (β/α) ratio, and effect size. For this study, I based all statistical analyses on weighted data. However, for the purpose of this power analysis, a subset (n = 1,592) of the data was used for sample size. An odds ratio (*OR*) of 1.68 was used in this power analysis. The odds ratio was estimated from previous studies (Hofman et al., 2013; Okuhara, Ishikawa, Okada, Kato, & Kiuchi, 2018; Pot et al., 2017) using a small effect size (Cohen's d) of 0.20, which was equivalent to an *OR* = 1.68 (Chen, Cohen, & Chen, 2010).

Type I errors (denoted by α) and Type II errors (denoted by β) are normally considered serious (Faul, Erdfelder, Buchner, & Lang, 2009; StatPower, n.d.). Type I errors occur when a null hypothesis is rejected when it is true, and Type II errors occur when a null hypothesis fails to be rejected when the alternative hypothesis is true (McCrum-Gardner, 2010). For this analysis, because both types of errors are equally serious, the β/α ratio was set at 1 rather than some other value like 2, which signifies that a researcher is 2 times more likely to commit a Type II error over a Type I error. Based

on the conditions for a compromise power analysis (N = 1,592, β/α ratio = 1, OR = 1.68, a two-tailed binomial test), I estimated power to be 0.981. This power estimate was adequate to detect a significant relationship between insurance coverage, the type of medical facility accessed for health care, and HPV vaccine completion, assuming that such significance existed.

Access to the Data Set

NIS-Teen data sets are publicly available. Data sets for public use can be downloaded from the CDC website. In addition to accessing the data set, users also can access and download all documents associated with the data set, including data documentation, a codebook, a data user's guide, a copy of the Household Interview Questionnaire that was used to collect the data, and the providers' immunization history questionnaire (CDC, 2016a). Because the data file was released in a format that was incompatible with commonly used statistical software, input statements were also provided to facilitate the transformation of the data into a format that is compatible with the software used to analyze the data (CDC, 2016a).

The NIS-Teen data are publicly available, and no special permission is required to use them. However, as per the National Center for Immunization and Respiratory Disease (NCIRD) and the CDC, users of the NIS-Teen data sets are asked to comply with the following statements (CDC, 2016a):

1. To only use the data files for analysis and statistical reporting.

2. If identifying information is inadvertently found, users are prohibited from using such information and are asked to contact the NCIRD upon such discovery.
3. Researchers are also prohibited from linking these data files with identifiable information with other NCIRD or non-NCIRD data files given respondent.

Use of the data signified the researcher's compliance with the aforementioned statements.

Instrumentation

The NIS-Teen is one of the surveys used by the CDC and NCIRD to monitor vaccine coverage among adolescents 13 to 17 years of age. After a measles outbreak in the early 1990s, the CDC (2016a) began using the NIS to track vaccination coverage in the United States. Since 1994, the NIS has been used to monitor vaccine coverage among children and adolescents as well as flu vaccination coverage among young children (CDC, 2016a). The survey is administered annually through telephone interviews to the parents of eligible adolescents in all 50 states, the District of Columbia, and some U.S. territories (CDC, 2016a). The NIS-Teen collects and provides the most current population-based state and local area estimates of vaccination coverage among U.S. adolescents (CDC, 2016a).

The survey has two parts: Part 1 collects household information, and Part 2 collects vaccination information from health care providers (CDC, 2016a). The household part of the survey has five sections (CDC, 2016a). Section A, which details instructions for the screener or the person conducting the interview; Section B, which collects vaccination information for current vaccines recommended for adolescents as

well as the flu vaccine; Section C, which collects demographic information; Section D, which collects health care provider information, and Section E, which collects information related to health insurance (CDC, 2016a). Part 2, the health care provider part of the survey, is used to verify vaccination information provided by the parents during the telephone interviews (CDC, 2016a). Health care providers are asked to complete information about their practices, services provided, and vaccine-related information pertaining to the children in question (CDC, 2016a).

Operationalization of Constructs

Insurance coverage was based on the insurance status of eligible Hispanic adolescents. Individual insurance status was coded "yes" (1) for having insurance coverage and "no" (0) for having no insurance coverage. Adolescents with insurance coverage were categorized as having private or public insurance. Being uninsured was defined as having no insurance coverage (CDC, 2016a).

Continuity in health insurance coverage was measured by periods of "no gap" in insurance coverage (CDC, 2016b). This included individuals who were currently insured and were never uninsured. Discontinuous coverage was measured by periods of "gap" in insurance coverage resulting from the loss of private or public insurance coverage. This included (a) individuals who were currently insured, but were uninsured at some point; and (b) individuals who were currently uninsured, but were insured at some point. This group also includes individuals who were currently uninsured and were never insured for the period in question.

Type of medical facility used to access health care was assessed as the facilities used to access primary care providers. This included public facilities, hospital, private practices, school-based clinics, and teen clinics (CDC, 2016b). In this study, the facilities were categorized as public facilities such as public health-operated clinics, hospital-based clinics, and private practices.

Vaccination status was defined as being immunized against HPV by receiving one of the three HPV vaccines currently available in the United States (CDC, 2016b). Vaccination status was defined operationally as whether or not a girl had been fully vaccinated with one of the recommended HPV vaccines, that is, if she had received all three doses of the vaccine. A "no" (0) response indicated that the girl had not been vaccinated, and a "yes" (1) response indicated that the girl had received at least one dose of the HPV vaccine series.

Data Analysis Plan

Secondary data from the 2016 NIS-Teen were analyzed using SPSS v.25 (IBM Corporation, 2017). Once the data were downloaded, I reviewed the data set for incorrect values, duplicated data, or missing data. To simplify the data set, I deleted all variables that were of no relevance to the study. Missing data were coded as such to ensure that they were handled appropriately during the analysis. In cases of nonresponses, the originator of the NIS-Teen data set imputed values to account for the missing data (CDC, 2016a). However, where applicable, missing data were excluded from all statistical analyses.

I recoded the variables of interest to the current study to answer the research questions. In cases where the variables were nominally scaled, the data were unlikely to have outliers; however, for numerical variables (e.g., age and date, if applicable), the data were assessed for outliers. As deemed necessary, I removed outliers based on the survey question being answered. All statistical analyses were based on weighted data. Statistical significance for all statistical tests was based on the standard alpha value ($\alpha = 0.05$). Whether a null hypothesis was accepted or rejected was assessed by the *p* value. If the *p* value was less than or equal to .05, the null hypothesis was rejected in favor of the alternative hypothesis. The research questions and hypotheses were as follows:

Research Question 1

Research Question 1: Is there a statistically significant relationship between health insurance coverage and the HPV vaccination status of Hispanic girls?

$H_0$1: There is no statistically significant association between health insurance coverage and the HPV vaccination status of Hispanic girls.

H_a1: There is a statistically significant association between health insurance coverage and the HPV vaccination status of Hispanic girls.

Health insurance status was operationalized as a nominal variable; insurance coverage was coded as 1, and no insurance was coded as 0. HPV vaccination status was operationalized as a nominal variable; vaccinated was coded as 1, and unvaccinated was coded as 0. The data were analyzed in three stages. For the first stage, univariate analysis was conducted. At this stage, descriptive statistics of the data were provided. For the second stage, bivariate analysis was conducted to assess the association between

insurance coverage and HPV vaccination status. This association was assessed using chi-square tests of association. In addition to chi-square tests, Cramer's V statistic was calculated to measure the strength of the relationship between health insurance coverage and completion of the HPV vaccine series. For the third stage, multiple logistic regression modeling was used to assess the association between insurance coverage and HPV vaccination completion, adjusting for maternal age, family income, maternal education, and health care provider recommendations.

Stepwise regression was used to fit the regression model. Variables were added to the model using forward selection, which starts with an empty model (i.e., a model with only the constant) and sequentially adds all of the other variables of interest (i.e., the independent variables and covariates). The significance of the model was assessed by the collective effect of the IV, as represented by χ^2 coefficient. The Nagelkerke R^2 assessed the variability on the dependent variable that was accounted for by the independent variable. The Wald coefficient was used to assess the significance of the IV. The probability that insurance coverage affected HPV vaccination coverage was determined by odds ratio and was interpreted as follow: An odds ratio value greater than 1.0 indicated an increased chance of completing the HPV vaccine series, and an odds ratio value less than 1.0 indicated a decreased chance of completing the vaccine series.

Research Question 2

Research Question 2: Is there a statistically significant relationship between the type of medical facility used to access health care and the HPV vaccination status of Hispanic girls?

$H_0$2: There is no statistically significant association between the type of medical facility used to access health care and the HPV vaccination status of Hispanic girls.

H_a2: There is a statistically significant association between the type of medical facility used to access health care and the HPV vaccination status of Hispanic girls.

Logistic regression was used to assess the extent to which the type of medical facility used to access health care affected completion of the HPV vaccine series. Type of medical facility used to access health care was operationalized as a nominal variable and was assessed based on the facility accessed for care, that is, private and public facilities or hospital-based clinics. Private facility was coded as 0, public facility was coded as 1, and hospital-based clinics were coded as 2. HPV vaccination status also was operationalized as a nominal variable; vaccinated was coded as 1, and unvaccinated was coded as 0.

I analyzed the data in three stages. For the first stage, univariate analysis was conducted. At this stage, descriptive statistics of the data were provided. For the second stage, bivariate analysis was conducted to assess the association between the type of medical facility used to access health care and HPV vaccination status. This was assessed using chi-square test of association. In addition to chi-square test, Cramer's V statistic was calculated to measure the strength of the relationship between the type of medical facility used to access health care and completion of the HPV vaccine series. For the third stage, multiple logistic regression modeling was used to assess the association between the type of medical facility used to access health care and HPV vaccination completion,

adjusting for maternal age, family income, maternal education, and provider recommendation.

Stepwise regression was used to fit the regression model. Variables were added to the model using forward selection. Forward selection starts with an empty model (i.e., a model with only the constant) and sequentially adds all the other variables of interest (i.e., the independent variables and covariates). The significance of the model was assessed by the collective effect of the independent variables as represented by χ^2 coefficient. The Nagelkerke R^2 was used to assess the variability on the dependent variable that was accounted for the independent variable. The Wald coefficient was used to assess the significance of the independent variable. The probability that the type of medical facility used to access health care affected HPV vaccination coverage was determined by odds ratio and was interpreted as follow: An odds ratio value greater than 1.0 indicated an increased chance of completing the HPV vaccine series, and an odds ratio value less than 1.0 indicated a decreased chance of completing the vaccine series.

Research Question 3

Research Question 3: Is there a statistically significant relationship between health insurance coverage and the type of medical facility used to access health care, and the likelihood of completing the HPV vaccine series?

$H_0$3: There is no statistically significant association between health insurance coverage and the type of medical facility used to access health care and the likelihood of completing the HPV vaccine series.

H_a3: There is a statistically significant association between health insurance coverage and the type of medical facility used to access health care and the likelihood of completing the HPV vaccine series.

Logistic regression was used to test the association between insurance coverage and the type of medical facility used to access health care, and HPV vaccination status. Health insurance status was operationalized as a nominal variable; no insurance was coded as 0, and insurance coverage was coded as 1. Type of medical facility used was operationalized as a nominal variable and was assessed based on access to private or public facilities and hospital-based clinics. Private facility was coded as 0; public facility was coded as 1, and hospital-based clinics were coded as 2. HPV vaccination status was operationalized as a nominal variable: unvaccinated was coded as 0, and vaccinated was coded as 1.

The data were analyzed in three stages. For the first stage, univariate analysis was conducted. At this stage, descriptive statistics of the data were provided. For the second stage, multivariate analysis was conducted to assess the association between insurance coverage and the type of medical facility used to access health care, and HPV vaccination status. This was assessed using multiple logistic regressions. For the third stage, multiple logistic regression modeling was used to assess the association between insurance coverage and the type of medical facility used to access health care, and HPV vaccination completion, adjusting for maternal age, family income, maternal education, and provider recommendation.

In the third stage, stepwise regression was used to fit the regression model. Variables were added to the model using forward selection, which starts with an empty model (i.e., a model with only the constant) and sequentially adds all the other variables of interest (i.e., the independent variables and covariates). The significance of the model was assessed by the collective effect of the independent variables, as represented by χ^2 coefficient. The Nagelkerke R^2 assessed the variability on the dependent variable that was accounted for by the independent variables. The Wald coefficient was used to assess the significance of the independent variables. The probability that insurance coverage and the type of medical facility used to access health care affected HPV vaccination coverage was determined by odds ratio and was interpreted as follow: An odds ratio value greater than 1.0 indicated an increased chance of completing the HPV vaccine series, and an odds ratio value less than 1.0 indicated a decreased chance of completing the vaccine series.

Statistical Assumptions: Chi-Square Test

Three key assumptions were made about the data when conducting a chi-square test for association. Preliminary investigation of the data was conducted to confirm that these assumptions were met. For the first and second assumptions, all of the variables used in this study were nominal variables falling into two or more independent categories (Laerd Statistics, 2018a). For example, HPV vaccination status had two groups: yes and no. The variable insurance coverage had two groups (i.e., insured and uninsured), and type of medical facility had three groups (i.e., private, public, and hospital). The variable discontinuity in insurance coverage was also consistent with this assumption because it

had four groups (insured and never uninsured, uninsured and never insured, currently insured but uninsured at some point, and currently uninsured but insured at some point). The third assumption (McHugh, 2013) that all expected values should have been greater than 5 for at least 80% of the cells included in the contingency table was met because all of the expected values were greater than 5 for chi-square tests of association conducted.

Statistical Assumptions: Multivariate Logistic Regression

Several key assumptions are made about the data when conducting a multivariate logistic regression (Laerd Statistics, 2018b): (a) The dependent variable should be a nominal (i.e., categorical) variable; (b) at least one of the independent variables should be categorical (i.e., ordinal or nominal variable) or continuous (i.e., interval or ratio variable); (c) the data should have independence of observations and the categories of dependent variables and independent variables should be mutually exclusive and exhaustive; (d) there should be no correlation or multicollinearity between the independent variables; (e) there should be a linear relationship between any continuous independent variables and the logit transformation of the dependent variable; and (f) the data set should not contain any outliers or highly influential points (Laerd Statistics, 2018b). Preliminary investigation of the data conducted confirmed that the logistic regression assumptions were met. The first and second assumptions were met because the dependent variable of HPV vaccine status was a dichotomous variable (yes/no) and the independent variables of insurance coverage and type of medical facility were nominal variables. There was no relationship between observations in the variables of interest because the categories of the dependent variable and independent variables were

mutually exclusive and exhaustive, thus satisfying the third assumption. Relative to the fourth assumption, the variance inflation factor value for the independent variables ranged from 1.007 to 2.862 suggesting moderate multicollinearity. However, because these values were below 5, the inclusion of these variables should not affect the regression model (Akinwande, Dikko, & Samson, 2015; Vatcheva, Lee, McCormick, & Rahbar, 2016). The fifth assumption presumed that there should have been a linear relationship between any continuous independent variables and the logit-transformed dependent variable. Because the independent variables in this study were nominal variables, this assumption was not jeopardized. Lastly, for the sixth assumption, boxplots produced by SPSS did not identify outliers in the data set.

Rationale for Inclusion of Covariates

Four covariates were taken into consideration in this study: health care providers' recommendation, maternal age, maternal education, and family income. Adolescents with health care providers' recommendation (Gilkey et al., 2016); higher family income (Polonijo & Carpiano, 2013); and other maternal-related socioeconomic indicators (e.g., age and education) were more likely than individuals without health care providers' recommendation and individuals with low socioeconomic status to complete the HPV vaccine series (CDC, 2016a; Fisher et al., 2013; Polonijo & Carpiano, 2013). Because these covariates were associated with reduced uptake of the HPV vaccine series (Fisher et al., 2013; Gilkey et al., 2016; Polonijo & Carpiano, 2013), their presence could have affected the relationships between the variables being evaluated in this study (Pourhoseingholi, Baghestani, & Vahedi, 2012). Consequently, regression models were

used to control for any effect that the covariates could have had on the dependent variable and the independent variables so that the relationships between the dependent variable and the independent variables was not masked by the presence of the covariates.

Threats to Validity

External Validity

External validity addresses factors within a study that might reduce the generalizability of the results (Polit & Beck, 2010). Generalizations can be made from samples to target populations, across populations, over time, and to other settings (Khorsan & Crawford, 2014). Relative to the current study, generalization of the results was limited to the design of the study. The NIS-Teen is a cross-sectional survey; hence, the information gathered from the respondents reflected that time period (i.e., 2016). Therefore, a study of this nature might not yield the same results a year or even 5 to 10 years from now. Similarly, the target population in the current study were Hispanic girls 13 to 17 years of age, so the results could not be generalized to girls 13 to 17 years of age from other racial or ethnic groups.

Another threat to the external validity of this study was the effect of the respondents' awareness that they were participating in a study. Because of this awareness, they might have responded in ways based on what they thought were expected from them rather than what was true. Hence, their responses might have been different from what they would have been in different settings or contexts.

Internal Validity

Internal validity refers to whether the exposure of interest (i.e., discontinuity in

insurance coverage or limited access to health care) made a difference on the outcome of interest (i.e., HPV vaccination status) and whether there was enough evidence to support such a claim (Sullivan, 2011). Inferences made based on the findings of this study could have been threatened by the instrument used to measure the variables of interest and by interviewer effects. The NIS-Teen and other surveys are conducted by the National Opinion Research Center at the University of Chicago under the direction of the CDC (CDC, 2016a). The instrument was a pretested, standardized questionnaire that was administered by highly trained screeners and interviewers, so threats of this nature were minimized (CDC, 2016a).

Subject effects also can threaten the internal validity of a study. Because the NIS-Teen is a cross-sectional survey, it could have been subjected to recall bias because the respondents were asked questions about the vaccination status of adolescents in the households. The responding parents might have provided information regarding the children's vaccination status that might not have been accurate. With the consent of the parents, health care providers were asked to verify the vaccination status of the children. In some cases, vaccination status reported by the parents might have been inflated and might not have matched the providers' records. Even though provider-verified vaccination information was crucial to estimating vaccine coverage, discrepancies in reporting might have gone unresolved because neither health care providers nor parents were contacted a second time to resolve such issues.

Construct Validity

Construct validity refers to the extent to which an instrument measures the

construct it is intended to measure (Westen & Rosenthal, 2003). Failure to operationalize all constructs appropriately can affect the conclusions of any studies. Using a single construct results in underrepresentation of the construct, making it difficult to assess the real effect of this construct on the outcome of interest (Westen & Rosenthal, 2003). NIS-Teen data have been used extensively, and as such, researchers have supported the robustness of the survey, thus minimizing this threat (CDC, 2016a).

Ethical Considerations

For this study, I used secondary data from the 2016 NIS-Teen that were released to the public for research purposes. All identifiable information or characteristics were removed from the data files before they were released to the public. The original researchers obtained informed consent from the respondent (i.e., the parent, male or female) who is most knowledgeable of the adolescents' vaccination histories. Data collectors were bound by a confidentiality agreement and instructions prohibiting disclosure of any identifiable information. The data were collected and processed under high security and strict confidentiality. The data set was used only for research purposes. Because the 2016 NIS-Teen data set was devoid of any personally identifiable information, to maintain that confidentiality of the respondents, no attempt was made to determine or obtain any of their personal identifiable information (Cohen & Mello, 2018).

Metcalf and Crawford (2016) posited that combining different data sets would result in composite pictures of individuals and reveal their identities. Therefore, the data set downloaded for this study was not shared with other researchers or combined with

other data sets in an effort to avoid the risk of invading the privacy of the respondents (Metcalf & Crawford, 2016). To assure the security of the data, they were stored on a password-protected external drive that was kept in a safety deposit box (Office of Research Integrity, n.d.). The data will be kept for 5 years, after which time they will be destroyed appropriately (Office of Research Integrity, n.d.). Before conducting any part of this study, formal approval to conduct this study was obtained from Walden University's Institutional Review Board (IRB approval #10-10-18-0538888).

Summary

In this study, I used a quantitative, cross-sectional design to assess the relationship between insurance coverage, the type of medical facility used to access health care, and completion of the HPV vaccine series by Hispanic girls 13 to 17 years of age. Secondary data from 2016 NIS-Teen were used to conduct the study. In Chapter 3, I discussed the research design and the rationale for selecting it. The target population was explained. The power associated with the sample size available for this study was determined by an a priori power analysis using G*Power 3.1. How the constructs of interest were operationalized also was discussed. Logistic regression was used to assess the significance of the relationship between insurance coverage and the type of medical facility used to access health care, and completion of the HPV vaccine series. The chapter concluded with a discussion of the factors that could have threatened the validity of the study and the ethical procedures that were followed throughout the study. In Chapter 4, I present the results of the study.

Chapter 4: Results

Introduction

The purpose of this quantitative cross-sectional study was to assess the extent to which insurance coverage and the type of medical facility used to access health care influenced completion of the HPV vaccine series among adolescent Hispanic girls 13 to 17 years of age. Presented in this chapter is a summary of the 2016 NIS-Teen response rates and the representativeness of the sample from which the data were collected. In this chapter, I provided a brief description of discrepancies found in data collection, the descriptive characteristics of the sample, the results of the analyses conducted to answer each research question, and a summary of the overall findings.

Survey Response Rates

The 2016 NIS-Teen response rate of 32.7% was representative of the total landline and cell phone numbers sampled (CDC, 2016a). This rate was measured using the Council of American Survey Research Organization method for telephone surveys (CDC, 2016a). The Council of American Survey Research Organization methods takes into consideration the resolution rate for the combined sample (i.e., the number of households with working residential telephone or active cell phone numbers, the screening completion rate for the combined sample, and the rate of interviews completed for eligible households for the combined sample; CDC, 2016a).

Representativeness of the Sample

The NIS-Teen telephone survey was weighted to be representative of all adolescents 13 to 17 years of age; weights were added as baseline-sampling and provider-

sampling weights (CDC, 2016a). For baseline-sample weights, because both landline and cell phone sampling were included in the 2016 NIS-Teen data collected, dual-frame weights were added to each adolescent with a completed household interview (CDC, 2016a). Dual-frame weights were used to reduce any bias associated with incompleteness in the landline sampling (CD, 2016a). For provider-sampling weights, weights were added to each adolescent with adequate provider data (CDC, 2016a).

Discrepancies in Data Collection

The HPV vaccine series is administered as a three-dose series at baseline (0 months), 2 months, and 6 months (CDC, 2017). However, upon review of the 2016 NIS-Teen data, it became evident that some households had reported that the subject of the interview received more than the maximum number of doses of the HPV vaccine. Similarly, a small percentage of the health care provider-verified HPV vaccine information showed that some adolescents had received more than three doses of the vaccine. Consequently, I removed cases with more than the required three doses of the HPV vaccine series from the data set.

Results

Descriptive Characteristics of the Study Sample

The 2016 NIS-Teen data file used for this study comprised data from adolescents from the United States and selected U.S. territories. The sample comprised 3,744 female Hispanic adolescents, representing a total of 2,483,816 (weighted) female Hispanic adolescents. The participants ranged in age from 13 to 17 years (M = 14.97 years,

SD = 1.399 years). Of the 2,483,816 female Hispanic adolescents who had completed the household interview, 64% had received a health care provider recommendation for the vaccine, 26% reported that they did not receive a health care provider recommendation for the vaccine, and 8% either refused to answer or did not know if the health care provider recommended the vaccine (see Table 1). Of the 2,483,816 female Hispanic adolescents, 20% had initiated and completed the HPV vaccine series, 10% did not complete the vaccine series, and the HPV vaccination status of 70% of the subjects was not reported. Of the 2,483,816 female Hispanic adolescents who had completed the health insurance module, 39% had health insurance coverage, 4% had no health insurance coverage, and 57% of the participants did not respond to this question. Of the 2,483,816 female Hispanic adolescents who completed the health insurance module, 6% had experienced gaps in insurance coverage at some point since the age of 11 years, 35% never experienced gaps in insurance coverage, 1% never had insurance, and 58% of the respondents did not respond to this question.

Relative to the type of medical facility accessed for care, cumulatively, 40% of the girls in this sample had access to a source of health care, 4% did not identify the source of health care, and 56% of participants did not complete this question. As the responding parent, 88% of the mothers were at least 34 years old or older and 12% were less than 34 years old. Twenty-one percent of the mothers had obtained some level of college education, 22% had self-identified as college graduates, 26% had completed high school, and 32% had less than 12 years of school. Twenty percent of the mothers reported family income greater than or equal to $75,000, 17% had family income between $40,001

and $75,000, and 51% had family income less than $40,000. Thirteen percent refused to answer or did not know about the family income.

Table 1

Descriptive and Demographic Characteristics of the Study Sample

Variable	Category	*N*	%
Age of adolescent (years)	13	483,561	19.5
	14	526,727	21.2
	15	542,249	21.8
	16	441,275	17.8
	17	490,004	19.7
Health care provider recommendation	Yes	1,586,407	63.9
	No	636,159	25.6
	Don't know/Refused	189,870	7.7
	Missing	71,380	2.9
HPV vaccination status	Yes	500,294	20.1
	No	247,783	10.0
	Missing	1,735,739	69.9
Insurance status	Uninsured	93,491	3.8
	Insured	966,802	38.9
	Missing	1,423,523	57.3
Continuity in health insurance coverage	Currently insured but uninsured at some point	90,065	3.6
	Currently insured, never uninsured	872,269	35.1
	Currently uninsured but insured at some point	62,839	2.5
	Currently uninsured, never insured	30,575	1.2
	Missing	1,428,068	57.5
Type of Medical Facility	Public	176,298	7.1
	Hospital	85,867	3.5
	Private	511,621	20.6
	STD/school/teen clinics/other facilities	37,721	1.5
	Mixed	177,147	7.1
	Unknown	96,382	3.9
	Missing	139,781	56.3
Maternal age	< 34 years	305,169	12.3
	34-44 years	1,315,619	53.0
	45 years and older	863,028	34.7
Family income	< $40,000	1,254,271	50.5
	$40,000-$75,000	417,269	16.8
	>$75,001	497,456	20.0
	Don't Know	200,983	8.1
	Refused	113,837	4.6
Mother's education	Less than 12 years	792,662	31.9
	High school	642,065	25.8
	Some college	513,532	20.7
	College graduate	535,558	21.6

Bivariate Analysis

Results of the Pearson's chi-square test identified statistically significant differences in the number of participants who had completed the HPV vaccine series by health insurance coverage status, $\chi 2$ (1, n = 715,277) = 552.40, $p < .001$ (see Table 2). This result suggested that girls who were insured were more likely than girls who were uninsured to complete the HPV vaccine series. However, the association between health insurance coverage and completion of the HPV vaccine was very weak (Cramer's V = .028).

Table 2

Contingency Table for Health Insurance Coverage and HPV Vaccination

Variable	Category	HPV vaccine up to date		Total
		No	Yes	
Insurance status	Uninsured	22,213	37,372	59,585
	Insured	213,446	442,246	655,692
	Total	235,659	479,618	715,277

Table 3 shows that completion of the HPV vaccine series was different for girls who had experienced a gap in insurance coverage and girls who had not. Results of the Pearson's chi-square test indicated that this difference was statistically significant, $\chi 2$ (1, n = 514,276) = 5550.35, $p < .001$. Although the association between continuity in health insurance coverage and completion of the HPV vaccine series was weak, Cramer's V = .104, the results suggested that HPV vaccine series completion was related to continuity in health insurance coverage.

Table 3

Contingency Table for Continuity in Health Insurance Coverage and HPV Vaccination

Variable	Category	HPV vaccine up to date		Total
		No	Yes	
Continuity of insurance coverage	No gap in insurance coverage	125,508	297,113	422,621
	Yes gap in insurance coverage	38,821	52,834	91,655
	Total	164,329	349,947	514,276

I conducted a chi-square test of association to assess the relationship between the type of medical facility accessed for health care and completion of the HPV vaccine series. Results of Pearson's chi-square test indicated a statistically significant difference in the percentage of participants who completed the HPV vaccine series by type of facility accessed for care, $\chi 2$ (2, n = 539,804) = 13903.294, $p < .001$. This result suggested that completion of the HPV vaccine series was significantly associated with having access to a health care facility; however, the association between the type of medical facility accessed and completion of the HPV vaccine series was small, Cramer's $V = .160$ (see Table 4).

Table 4

Contingency Table for Type of Medical Facility Used to Access Care and HPV Vaccination

Variable	Category	HPV vaccine up to date		Total
		No	Yes	
Type of medical facility	Public facilities	48,097	82,791	130,888
	Private practice	93,175	48,394	341,569
	Hospitals	33,126	34,221	67,347
	Total	174,398	365,406	539,804

Research Question 1 and Hypotheses

Research Question 1: Is there a statistically significant relationship between health insurance coverage and the HPV vaccination status of Hispanic girls?

$H_0$1: There is no statistically significant association between health insurance coverage and the HPV vaccination status of Hispanic girls.

H_a1: There is a statistically significant association between health insurance coverage and the HPV vaccination status of Hispanic girls.

I included HPV vaccination, health insurance coverage, and the covariates of maternal age, maternal education, family income, and health care providers' recommendation in the final regression model. The regression results showed that the addition of HPV vaccination status, health insurance coverage, maternal age, maternal education, family income, and health care providers' recommendation significantly improved the fit between the final model and the data, $\chi 2$ (df = 5, n = 709,274) = 38752.04, $p < .001$. The inclusion of HPV vaccination status, health insurance coverage, maternal age, maternal education, family income, and health care providers' recommendation in the final model explained between 5.3% (Cox & Snell R^2) and 7.4% (Nagelkerke R^2) of the variance in completing the HPV vaccine series, and the final model correctly classified 68.6% of the cases.

Table 5 is a summary of the logistic regression coefficient beta (B), the Wald statistics, the odds ratio, and its 95% confidence interval (CI). Based on Wald statistics, the covariates of maternal age, maternal education, family income, and health care providers' recommendation were significantly associated with completing the HPV vaccine series ($p < .001$). After controlling for maternal age, maternal education, family income, and health care providers' recommendation in the final model, Hispanic girls who were uninsured were .878 times less likely to complete the HPV vaccine series (B =

-.130, *OR* = .878, 95% CI [.862, .894]) compared to girls who are insured. As family income increases, the odds of completing the HPV vaccine decreased by .989 (*B* = -.011, *p* < .001; *OR* = .989, 95% CI [.989, .990]), and not having a health care providers' recommendation decreased the odds of completing the HPV vaccine series by .988 (*B* = -.012, *p* < .001; *OR* = .988, 95% CI [.988, .988]). As maternal age increases, the odds of completing the HPV vaccine series increased by 1.0 (*B* = .024, *p* < .001; *OR* = 1.025, 95% CI [1.016, 1.033]), and as maternal education increases, the odds of completing the HPV vaccine series increased by 1.3 (*B* = .268, *p* < .001; *OR* = 1.308, 95% CI [1.301, 1.314]). Therefore, I rejected the null hypothesis in favor of the alternative hypothesis that there is a statistically significant association between health insurance coverage and completion of the HPV vaccine series after controlling for maternal age, maternal education, family income, and health care providers' recommendation.

Table 5

Logistic Regression Results for Completing HPV Vaccine Series Based on Health Insurance Coverage

Variable	*B*	*SE*	*Wald*	*df*	Sig.	*OR*	95% CI	
							Lower	Upper
Provider recommendation	-.012	.000	8398.33	1	.000	.988	.988	.988
Maternal age	.024	.004	36.05	1	.000	1.025	1.016	1.033
Maternal education	.268	.002	12486.71	1	.000	1.308	1.301	1.314
Family income	-.011	.000	12614.82	1	.000	.989	.989	.990
Uninsured	-.130	.009	196.29	1	.000	.878	.862	.894

To expand on the insurance coverage model, I conducted a stepwise multiple logistic regression using forward selection to assess the significance of the relationship between continuity in health insurance coverage and completion of the HPV vaccine

series among Hispanic girls. The regression results showed that the addition of HPV vaccination status, continuity in health insurance coverage, maternal age, maternal education, family income, and health care providers' recommendation to the final model improved the fit between the final model and the data, $\chi 2$ ($df = 7$, $n = 704{,}805$) = 53759.14, $p < .001$. The inclusion of HPV vaccination status, continuity in health insurance coverage, maternal age, maternal education, family income, and health care providers' recommendation in the final model explained between 7.3% (Cox & Snell R^2) and 10.2% (Nagelkerke R^2) of the variance in completing the HPV vaccine series, and the final model correctly classified 70.5% of the cases.

Table 6 is a summary of the logistic regression coefficients beta (*B*), the Wald statistics, the odds ratio, and its 95% CI. Based on Wald statistics, maternal age, maternal education, family income, health care providers' recommendation, and continuity in insurance coverage were significantly associated with completing the HPV vaccine series ($p < .001$). After controlling for maternal age, maternal education, family income, and health care providers' recommendation, having gaps in insurance coverage significantly increased the odds of completing the HPV vaccine series.

Compared to girls who were uninsured, girls who were currently insured, but had been uninsured at some point since 11 years old, were 1.6 times more likely to complete the HPV vaccine series ($B = .460$, $p < .001$; $OR = 1.584$, 95% CI [1.529, 1.641]). Likewise, girls who were currently uninsured, but had been insured at some point since 11 years old, were 4.5 times more likely to complete the vaccine series compared to girls who were uninsured ($B = 1.505$, $p < .001$; $OR = 4.505$, 95% CI [4.333, 4.684]).

Furthermore, girls who were continuously insured were 3.3 times more likely than girls who are uninsured to complete the vaccine series (B = 1.205, p < .001; OR = 3.337, 95% CI [3.232, 3.446]). Maternal age, maternal education, family income, and health care providers' recommendation were significantly associated with completion of the HPV vaccine series. As family income increases, the odds of completing the HPV vaccine series decreased by .99 (B = -.010, p < .001; OR = .990, 95% CI [990, .990]), and not having a health care provider recommendation decreased the odds of completing the vaccine series by .99 (B = -.012, p < .001; OR = .988, 95% CI [.987, .988]). As maternal age (B = .032, p < .001; OR = 1.033, 95% CI [1.024, 1.041]) and maternal education increases (B = .257, p < .001; OR = 1.293, 95% CI [1.287, 1.299]), the odds of completing the HPV vaccine series increased by 1.0 and 1.2, respectively. This result provided further evidence to support my rejection of the null hypothesis in favor of the alternative hypothesis that there is a statistically significant association between health insurance coverage and completion of the HPV vaccine series after controlling for maternal education, maternal age, family income, and health care providers' recommendation.

Table 6

Logistic Regression Results for Completing HPV Vaccine Series Based on Continuity in Health Insurance Coverage

Variable	*B*	*SE*	*Wald*	*df*	Sig.	*OR*	95% CI	
							Lower	Upper
Currently insured but uninsured at some point since age 11	.460	.018	652.55	1	.000	1.584	1.529	1.641
Currently insured and never uninsured since age 11	1.205	.016	5409.65	1	.000	3.337	3.232	3.446
Currently uninsured but insured at some point since age 11	1.505	.020	5727.82	1	.000	4.505	4.333	4.684
Mother's age	.032	.004	60.71	1	.000	1.033	1.024	1.041
Mother's education	.257	.002	11078.88	1	.000	1.293	1.287	1.299
Family income	-.010	.000	9751.79	1	.000	.990	.990	.990
Provider's recommendation	-.012	.000	8902.02	1	.000	.988	.987	.988

Research Question 2 and Hypotheses

Research Question 2: Is there a statistically significant relationship between the type of medical facility used to access health care and the HPV vaccination status of Hispanic girls?

$H_0$2: There is no statistically significant association between the type of medical facility used to access health care and the HPV vaccination status of Hispanic girls.

H_a2: There is a statistically significant association between the type of medical facility used to access health care and the HPV vaccination status of Hispanic girls.

For this research question, I conducted a stepwise multiple logistic regression using forward selection to assess the significance of the relationship between the type of medical facility used to access health care and completion of the HPV vaccine among Hispanic girls. Relative to the type of health care facility accessed, only categories that were significant contributor to the final model were evaluated. The covariates maternal age, maternal education, family income, and health care providers' recommendation

included in the final regression model were significantly ($p \leq .05$) associated with uptake of the HPV vaccines. The regression results showed that the addition HPV vaccination status, the type of medical facility accessed, maternal age, maternal education, family income, and health care providers' recommendation to the model significantly support the fit between the final model and the data, $\chi 2$ ($df = 6$, $n = 534{,}300$) = 47883.08, $p <$ .001. However, the addition of HPV vaccination status, the type of medical facility accessed, maternal age, maternal education, family income, and health care providers' recommendation to the final model explained between 8.6% (Cox & Snell R^2) and 12% (Nagelkerke R^2) of the variance in completing the HPV vaccine series, and 70% of the cases in the final model were correctly classified.

Table 7 is a summary of the logistic regression coefficients beta (B), the Wald statistics, the odds ratio, and its 95% CI. Based on Wald statistics, maternal age, maternal education, family income, and health care providers' recommendation, and the type of medical facility accessed were significantly associated with completing the HPV vaccine series, $p < .001$. After controlling for maternal age, maternal education, family income, and health care providers' recommendation, the type of medical facility, that is, whether the health care provider was accessible via public facilities ($B = .460$, $p < .001$; $OR = 1.584$, 95% CI [1.553, 1.617]) or private practice ($B = .821$, $p < .001$; $OR = 2.273$, 95% CI [2.233, 2.314]) increased the odds of completing the HPV vaccine series. As maternal age ($B = .239$, $p < .001$; $OR = 1.270$, 95% CI [1.258, 1.282]) and maternal education increases ($B = .095$, $p < .001$; $OR = 1.100$, 95% CI [1.094, 1.107]), the odds of completing the HPV vaccine series increased by 1.2 and 1.1, respectively. However,

family income (B = -.013, p < .001; OR = .987, 95% CI [.987, .987]) and health care providers' recommendation (B = -.017, p < .001; OR = .983, 95% CI [.983, .983]) decreased the odds of completing the HPV vaccine series. Therefore, I rejected the null hypothesis in favor of the alternative hypothesis that there is a statistically significant association between the type of medical facility accessed for health care and completion of the HPV vaccine series after controlling for maternal age, maternal education, family income, and health care providers' recommendation.

Table 7

Logistic Regression Results for Completing HPV Vaccine Series Based on Type of Medical Facility Used to Access Health Care

Variable	*B*	*SE*	*Wald*	*df*	Sig	*OR*	95% CI	
							Lower	Upper
Maternal age	.239	.005	2506.32	1	.000	1.270	1.258	1.282
Maternal education	.095	.003	1021.60	1	.000	1.100	1.094	1.107
Family income	-.013	.000	13289.29	1	.000	.987	.987	.987
Provider recommendation	-.017	.000	12215.17	1	.000	.983	.983	.983
Facility type - public	.460	.010	1991.12	1	.000	1.584	1.553	1.617
Facility type - private	.821	.009	8134.15	1	.000	2.273	2.233	2.314

Research Question 3 and Hypotheses

Research Question 3: Is there a statistically significant relationship between health insurance coverage, the type of medical facility used to access health care, and the likelihood of completing the HPV vaccine series?

$H_0$3: There is no statistically significant association between health insurance coverage, the type of medical facility used to access health care, and the likelihood of completing the HPV vaccine series.

H_a3: There is a statistically significant association between health insurance coverage, the type of medical facility used to access health care, and the likelihood of completing the HPV vaccine series.

Stepwise multiple logistic regression was conducted to assess the significance of the relationship between health insurance coverage, the type of medical facility used to access health care and the likelihood of completing the HPV vaccine series among Hispanic girls. Relative to the type of health care facility accessed, only categories that were significant contributor to the final model were evaluated. The covariates maternal age, maternal education, family income, and health care providers' recommendation included in the final regression model were significantly ($p \leq .05$) associated with uptake of the HPV vaccines. The regression results showed that the addition of the HPV vaccination status, health care insurance, the type of medical facility accessed, maternal education, maternal age, family income, and health care provider recommendation to the final model significantly improved the fit between the model and the data, $\chi 2$ ($df = 7$, $n = 510{,}020$) = 51595.98 $p < .001$. The variables in the final model explained between 9.6% (Cox & Snell R^2) and 13.5% (Nagelkerke R^2) of the variance in completing the HPV vaccine series, and the final model correctly classified 70.1% of the cases.

Presented in Table 8 is a summary of the logistic regression coefficients beta (B), the Wald statistics, the odds ratio, and its 95% CI. Wald statistics showed that after controlling for maternal age, maternal education, family income, and health care providers' recommendation, health insurance coverage, more specifically being

uninsured, was significantly associated with completing the HPV vaccine series. For girls who were uninsured, the odds of completing the HPV vaccine series decreased by .942 (B = -.060, p < .001; OR = .942, 95% CI [.921, .963]). The type of medical facility used to access health care significantly influenced completion of the HPV vaccine series. Access to a public health care facility (B = .514, p < .001; OR = 1.672, 95% CI [1.637, 1.707]) or a private practice (B = .823, p < .001; OR = 2.277, 95% CI [2.235, 2.319]) increased the odds of completing the HPV vaccine series by 1.67 and 2.27, respectively. Maternal age, maternal education, family income, and health care providers' recommendation significantly impacted completion of the HPV vaccine series. Increases in family income (B = -.014, p < .001; OR = .986, 95% CI [.986, .986]) and lack of a health care provider recommendation (B = -.018, p < .001; OR = .988, 95% CI [.981, .982]), decreased the odds of completing the HPV vaccine series. As maternal age (B = .252, p < .001; OR = 1.286, 95% CI: 1.274, 1.299) and maternal education level increases (B = .125, p < .001; OR = 1.133, 95% CI [1.126, 1.140]), the odds of completing the HPV vaccine series increased. Hence, the null hypothesis was rejected in favor of the alternative hypothesis that there is a statistically significant association between health insurance coverage, the type of medical facility used to access health care and the likelihood of completing the HPV vaccine series after controlling for maternal age, maternal education, family income, and health care provider recommendation.

Table 8

Logistic Regression Results for HPV Vaccination Based on Discontinuity in Health Insurance Coverage and Type of Medical Facility Used to Access Health Care

Variable	*B*	*SE*	*Wald*	*df*	Sig	*OR*	95% CI	
							Lower	Upper
Maternal Age	.252	.005	2598.46	1	.000	1.286	1.274	1.299
Maternal Education	.125	.003	1588.93	1	.000	1.133	1.126	1.140
Family Income	-.014	.000	14637.87	1	.000	.986	.986	.986
Provider Recommendation	-.018	.000	13043.45	1	.000	.982	.981	.982
Facility type – Public	.514	.011	2351.63	1	.000	1.672	1.637	1.707
Facility type – Private	.823	.009	7738.53	1	.000	2.277	2.235	2.319
Insurance Status: Uninsured	-.060	.011	28.63	1	.000	.942	.921	.963

As indicated in Table 9 below, the addition of continuity in health insurance coverage to the final model improved the outcome of the relationship between the type of medical facility used to access health care and completion of the HPV vaccine series. Results suggested that continuity in insurance coverage and the type of medical facility used to access health care significantly influenced the likelihood of completing the HPV vaccine series. Hispanic girls who were continuously insured were 3.5 times more likely to complete the HPV vaccine series ($B = 1.263$, $p < .001$; $OR = 3.536$, 95% CI [3.400, 3.678]). Similarly, compared to girls who were uninsured, girls who experienced gaps in insurance coverage were more likely to complete the vaccine series, whether they were currently insured, but were uninsured at some previous point ($B = .180$, $p < .001$; $OR = 1.198$, 95% CI [1.148, 1.250]), or they were currently uninsured, but were insured at some previous point ($B = 1.480$, $p < .001$; $OR = 4.395$, 95% CI [4,198, 4,601]). Access to public health care facilities ($B = .699$, $p < .001$; $OR = 2.011$, 95% CI [1.969, 2.055]) or private facilities ($B = .967$, $p < .001$; $OR = 2.654$, 95% CI [2.605, 2. 704]) increased the odds of completing the HPV vaccine series. Maternal age, maternal education, family

income, and health care providers' recommendation significantly impacted completion of the HPV vaccine series. As family income increases (B = -.013, p < .001; OR = .987, 95% CI [.987, .988]) and without a health care provider recommendation (B = -.020, p < .001; OR = .981, 95% CI [.980, .981]), the odds of completing the HPV vaccine series decreased. As maternal age (B = .322, p < .001; OR = 1.380, 95% CI [1.366, 1.394]) and maternal education increases (B = .099, p < .001; OR = 1.104, 95% CI [1.098, 1.111]), the odds of completing the HPV vaccine series increased. The final model was statistically significant, $\chi 2$ (df = 9, n = 509,014) = 68524.30, p < .001, and it correctly classified 75% of the cases. The inclusion of continuity in health care insurance, medical facility type, maternal age, maternal education, family income, and health care provider recommendation in the final model explained between 12.6% (Cox & Snell R^2) and 17.7% (Nagelkerke R^2) of the variance in completing the HPV vaccine series. This provided further evidence in support of rejecting the null hypothesis in favor of the alternative hypothesis that there is a statistically significant association between health insurance coverage, the type of medical facility used to access health care, and the likelihood of completing the HPV vaccine series after controlling for maternal age, maternal education, family income, and provider recommendation.

Table 9

Logistic Regression Results for HPV Vaccination Based on Discontinuity in Health Insurance Coverage and Type of Medical Facility Used to Access Health Care

Variable	*B*	*SE*	*Wald*	*df*	Sig	*OR*	95% CI	
							Lower	Upper
Maternal age	.322	.005	4042.633	1	.000	1.380	1.366	1.394
Maternal education	.099	.003	968.31	1	.000	1.104	1.098	1.111
Family income	-.013	.000	11135.20	1	.000	.987	.987	.988
Provider recommendation	-.020	.000	14237.36	1	.000	.981	.980	.981
Facility type - public	.699	.011	4120.07	1	.000	2.011	1.969	2.055
Facility type - private	.976	.010	10429.09	1	.000	2.654	2.605	2.704
Currently insured but uninsured at some point since age 11	.180	.022	69.17	1	.000	1.198	1.148	1.250
Currently insured and never uninsured since age 11	1.263	.020	3956.22	1	.000	3.536	3.400	3.678
Currently uninsured but insured at some point since age 11	1.480	.023	4004.99	1	.000	4.395	4.198	4.601

Summary

In this chapter**,** weighted data from the 2016 NIS-Teen were evaluated to determine the extent to which health insurance coverage and the type of medical facility used to access health care influenced the likelihood of Hispanic female adolescents completing the HPV vaccine series. In this chapter, I presented the results of the data analysis conducted to answer the three research questions. The sample comprised data from 3,744 Hispanic female adolescents that were weighted to represent 2,483,816 Hispanic female adolescents. However, not all survey data were included in the analyses; missing data were removed from all statistical analyses.

Based on the results of the chi-square tests, completion of the HPV vaccine series was associated with health insurance coverage and the type of medical facility used to access health care. In addition to health insurance coverage, continuity in health insurance coverage was significantly associated with completing the HPV vaccine series.

The final multiple logistic regression models were used to examine the influence of the type of medical facility used to access health care and health insurance coverage on HPV completion status showed that the type of medical facility used to access health care and health insurance coverage were significantly associated with HPV completion status.

The key findings were that after controlling for maternal age, maternal education, family income, and health care providers' recommendation, a statistically significant relationship was found among completion of the HPV vaccine series, health insurance coverage, and the type of medical facility used to access health care. Continuity in health insurance coverage improved the likelihood of completing the HPV vaccine series. Although Hispanic female adolescents who were uninsured were less likely to complete the HPV vaccine series, Hispanic female adolescents who are continuously insured were more likely to complete the vaccine series by accessing their health care providers via public health care facilities or private practice. Based on the results, the null hypothesis that there is no significant association between health insurance coverage and the type of medical facility used to access health care, and completion of HPV vaccine series was rejected.

Included in Chapter 5 is my interpretation of the findings of this study based on published research on the effects of health insurance coverage and access to sources of health care on HPV vaccine uptake among Hispanic female adolescents. In Chapter 5, I discussed the limitations of the study and the implications for positive social change. I also provide a detailed description of recommendations for future studies and a conclusion to complete the chapter.

Chapter 5: Discussion, Recommendations, and Conclusion

Introduction

Increasing the completion rate of the HPV vaccine series among Hispanic female adolescents has the potential to significantly reduce HPV infections and the prevalence and mortality rates of cervical cancer among Hispanic women (Valentino & Poronsky, 2016). Despite the effectiveness of the HPV vaccines and the ACIP's recommendations to vaccinate female adolescents, HPV vaccine coverage rates remain low among Hispanic female adolescents (Jeudin et al., 2014; Markowitz et al., 2014). These low coverage rates could be related to inadequate insurance coverage and limited access to health care. In this quantitative cross-sectional study, I evaluated the extent to which health insurance coverage and access to health care based on the type of medical facility used influenced completion of the HPV vaccine series among Hispanic female adolescents. The SEM served as the theoretical framework of the study. The understanding gained from this study can be used to guide the development of strategies to boost HPV vaccination coverage among Hispanic female adolescents.

In this study, I evaluated data from the 2016 NIS-Teen to determine the extent to which health insurance coverage and the type of medical facility used to access health care influenced the likelihood of Hispanic female adolescents completing the HPV vaccine series. The results of Pearson's chi-square tests showed that completion of the HPV vaccine series was significantly associated with health insurance coverage and the type of medical facility used to access health care. Likewise, continuity in health insurance coverage was significantly associated with completing the HPV vaccine series.

Further analyses using stepwise multiple logistic regression showed that after controlling for maternal age, maternal education, family income, and health care providers' recommendation, completion of the HPV vaccine series was significantly associated with health insurance coverage; more specifically, there was a significant association between being uninsured and completing the HPV vaccine series.

Interpretation of the Findings

For children from ethnic or racial minorities, Smits-Seemann et al. (2016) found that gaps in health insurance coverage for any period were associated with either casual use of or a lack of a usual source of preventive care. However, in the current study, gaps in insurance coverage did not adversely affect the completion of the HPV vaccine series by Hispanic female adolescents. Results of multiple logistic regression showed that gaps in insurance coverage since age 11 years significantly increased the likelihood of Hispanic female adolescents completing the vaccine series. This result contradicted Cowburn et al.'s (2014) findings that although there was no association between insurance coverage and completion of the vaccine series, study participants who were uninsured for some time were unlikely to initiate the HPV vaccine series. The differences in association could have been attributed to one of many factors, including, but not limited to, sampling weights used in the current study and bias in the analyses because of missing data. The pattern of missing data can substantially result in over- or underestimation of the odds of completing the HPV vaccine series based on gaps in insurance coverage. In this analysis, it is possible that the odds ratio for HPV vaccine

series completion based on gaps in insurance coverage was overestimated, and therefore, the results were biased away from the null hypothesis.

Results of the multiple logistic regressions showed that there was an association between the lack of health insurance coverage and completion of the HPV vaccine series. More specifically, being uninsured decreased the likelihood of Hispanic female adolescents completing the HPV vaccine series. Conversely, continuous health insurance coverage increased the likelihood of Hispanic female adolescents completing the HPV vaccine series. This result confirmed the findings of Reiter et al. (2014), who found that when compared to Hispanic female adolescents who were insured, those who were uninsured were less likely to comply with all vaccine requirements, including completion of the three-dose HPV vaccine series.

Jeudin et al. (2014) identified the lack of insurance as a barrier to HPV vaccination for girls from ethnic or racial minorities, including Latina girls, who were less likely to complete the vaccine series. Using data from the 2015 NIS-Teen, Lu et al. (2018) also showed that, after adjusting for confounding factors, coverage for all vaccines, including the HPV vaccine series, was lower among adolescents who were uninsured than for adolescents who were insured. Furthermore, De Jesus and Xiao (2014) found that continuity in health insurance coverage was predictive of Latinos' access to health care services. Although the results of this study confirmed that a lack of insurance coverage negatively influences the completion of the HPV vaccine series, the low rate of vaccine completion noted undermined the overall impact of health insurance coverage on completing the vaccine series. Likewise, although continuous health insurance coverage

was essential to completing the vaccine series, the high percentage of missing values on the variables of interest also undermined its impact on completing the vaccine series.

Researchers have concluded that compared to other racial and ethnic groups in the United States, Hispanics are less likely to use preventive care services (Gelman et al., 2013; Polonijo & Carpiano, 2013; Velasco-Mondragon et al., 2016). Because Hispanics have less access to preventive care services or have no access at all, they are more likely to be underimmunized (Gelman et al., 2013). However, the results of this study did not support this finding. Instead, the results showed that Hispanic female adolescents with access to a source of care, whether private or public, have increased odds of completing the HPV vaccine series. This result was consistent with the findings reported by Test et al. (2013) that girls with permanent medical homes were more likely to be vaccinated.

Although access to a health care facility can include hospitals, school-based clinics, and other health care facilities, these facilities were excluded from all statistical analysis in this study, so their contributions to increasing the rate of HPV vaccine uptake could not be ascertained. Furthermore, the results of this study confirmed that having access to a source of health care increased the likelihood of Hispanic female adolescents completing the HPV vaccine series. However, the high percentage of missing values on the variable used to assess the type of medical facility used to access health care minimized the ability to assess the overall impact of the source of health care on completing the HPV vaccine series.

All of the variables included in the multivariate regression analysis significantly affected the ability of the final model to assess HPV vaccine completion. The results of

this study indicated that maternal age and maternal education increased the likelihood of Hispanic female adolescents' completing the HPV vaccine series. However, health care providers' recommendation and family income decreased their likelihood of completing the HPV vaccine series.

Researchers have asserted that health care providers' recommendation is a key predictor of being vaccinated against HPV (Brewer et al., 2011; Gilkey et al., 2015, 2016; Holman et al., 2014; Reiter, McRee et al., 2013). In previous studies, Hispanic girls were found to be less likely to receive a recommendation for the vaccine from their health care providers and were less likely to receive the HPV vaccine in the absence of such a recommendation (Gilkey et al., 2015, 2016; Morales-Campos et al., 2013). The results of my study showed that Hispanic girls are less likely to complete the HPV vaccine series without a health care provider's recommendation; however, they also showed that even though more than 60% of the Hispanic female adolescents in the sample had a provider recommendation for the vaccine series, only 20% completed the three doses. Therefore, according to the findings in my study, it appears that a health care provider's recommendation does not influence the completion of the HPV vaccine series. It is probable that the strength of the recommendation may be more influential on completing the HPV vaccine series; however, this factor was not assessed in this study (see Kester, Zimet, Fortenberry, Kahn, & Shew, 2013). Receiving a recommendation from health care providers for the HPV vaccine may be crucial to initiating the vaccine series, but the factors affecting the completion of the vaccine series may be different from those required to initiate it (Monnat, Rhubart, & Wallington, 2016). Therefore, as I found in

this study, the recommendation made by health care providers alone may not be as influential on HPV vaccine completion as predicted.

Higher family income has been inconsistently associated with HPV vaccine completion (Gold et al., 2013; Laz et al., 2010; Polonijo & Carpiano, 2013). However, based on the results of my study, higher family income significantly decreased the odds of Hispanic female adolescents completing the HPV vaccine series. This finding was comparable to the results of Walker et al. (2018). Using data from the 2017 NIS-Teen, these authors found that compared to adolescents with family incomes below the poverty level, adolescents from families with incomes at or above the poverty level were less likely to receive all three doses of the HPV vaccine series (Walker et al., 2018). The finding in the current study is comparable to that of at least one group of researchers; however, it should be noted that missing values for family income were imputed. Based on the values imputed, it is probable that girls from families that had incomes at or above the poverty level were less likely to complete the vaccine series.

I used the SEM as the theoretical framework of this study. This model posits that intrapersonal factors, interpersonal factors, organizational or institutional factors, community-related factors, and social factors can influence the risks of a given health-related outcome, in this case, not completing the HPV vaccine series (see Baral et al., 2013; Chimphamba-Gombachika er al., 2012; Nyambe et al., 2016). Although not all of the factors were evaluated in this study, results showed that maternal education, maternal age, and family income (i.e., intrapersonal factors); health care providers' recommendation to get the HPV vaccine series (i.e., interpersonal factors); health care

providers' accessibility (i.e., organizational or institutional factors); and insurance coverage (i.e., community-related factors) influenced the likelihood of Hispanic female adolescents completing the HPV vaccine series. Although maternal age, maternal education, continuous health insurance coverage, and access to a source of health care increased the odds of completing the HPV vaccine series, health care providers' recommendation and family income decreased the likelihood of completing the vaccine series. A recommendation from a health care provider is likely to increase the odds of receiving the HPV vaccine (Gilkey et al., 2015); however, in this study, the lack of such a recommendation or a casual recommendation reduced the likelihood of receiving the HPV vaccine.

The HPV vaccine series is one of the most expensive vaccines currently available in the United States (CDC, 2015b), yet individuals covered by public or private insurance do not have any financial hindrance to receiving the vaccine. However, for individuals who are uninsured, are underinsured, or have experienced gaps in insurance coverage, completion of the HPV vaccine series may be problematic (DeVoe et al., 2015; Fairbrother et al., 2011). The results of this study confirmed that Hispanic female adolescents who were uninsured were less likely than Hispanic female adolescents with continuous insurance coverage to complete the vaccine series. However, I found that gaps in insurance coverage did not adversely affect completion of the HPV vaccine series. More research is needed to establish whether gaps in insurance coverage affect vaccine receipt and completion. Overall, the results of my study corroborated the tenets of the SEM that different contextual factors influence the risk of a given health-related outcome

(see Baral et al., 2013; Lanning et al., 2017; Nyambe et al., 2016; Paat, 2013). Because these factors are interconnected, public health guidelines aimed at addressing the low uptake of all three doses of the HPV vaccine series should take into consideration strategies that will create change on different levels.

Limitations of the Study

I used secondary data from the 2016 NIS-Teen. As a result, the evaluations documented in this study were restricted to questions asked in the survey and were limited to variables in the NIS-Teen data set. There were high percentages of missing values for the variables of interest to the study. Therefore, despite adjustment for nonresponses from health care providers and household interviews and households without access to telephones or cell phones, the results of the analyses might have been biased due to the high percentage of missing values. The analyses described in this study used weighted data, so it is possible that the significance of the associations reported was overestimated. Missing data can limit the validity of secondary data sources, so given the high percentage of missing information on the dependent variable and the independent variables evaluated in this study, the results should be interpreted judiciously.

Recommendations for Future Studies

I evaluated insurance coverage and the type of medical facility used to access health care in this study to assess the extent to which they affected the completion of the HPV vaccine series. Given the low vaccine coverage rate reported in this study, more research may be necessary to identify factors that might be more influential in the uptake and completion of the HPV vaccine series. In this study, I used secondary data to

evaluate the relationship between insurance coverage, gap in insurance coverage, the type of medical facility used to access health care, and completion of the HPV vaccine series. Hence, the use of instruments more tailored to specifically assessing insurance coverage, gaps in insurance coverage, and access to a source of health care relative to HPV vaccine completion is recommended. In light of the conflicting findings regarding the effects of gaps in health insurance coverage on completion of the HPV vaccine series, further research is needed to clarify or reduce any ambiguity surrounding the contradicting findings discussed in this chapter.

Implications for Positive Social Change

Improving the uptake rate of the HPV vaccine series by Hispanic female adolescents has several implications for positive social change. The cost of the HPV vaccine series is one of the greatest barriers to its completion, so the results of this study could help to guide the development of effective strategies to increase HPV vaccination rates among Hispanic female adolescents by implementing policies that support continuity in insurance coverage. Streamlining Medicaid policies to renew coverage can minimize periods of no health coverage for adolescents. Where applicable, provisions should be made for continued health coverage until renewal conditions are met. Such provisions would ensure that Hispanic female adolescents could receive the vaccines promptly and complete the vaccine series in a timely manner.

In the United States, the prevalence of HPV has decreased since the introduction of the HPV vaccines (Markowitz et al., 2016). This reduction has been partially the result of adopting various methods designed to raise awareness of HPV, the HPV vaccine

series, and HPV-related diseases. Relative to social change in the Hispanic community, heightened awareness could boost the receipt and completion of the HPV vaccines series by Hispanic female adolescents. Subsequently, this boost in the uptake of the HPV vaccine series could help to reduce the risk of HPV infections and the incidence of HPV-related cancers over time.

Each year, public health efforts to prevent cervical cancer save billions of dollars. It has been estimated that the United States spends more than 80% of its annual budget to treat and prevent cervical cancer (Coyne-Beasley & Hochwalt, 2016). In Texas, for example, a state with a high incidence of cervical cancer, within the first year of diagnosis, more than $60,000 per patient is spent to treat women with cervical cancer (Lairson et al., 2017). Even though the HPV vaccine does not replace cervical cancer screening tools and other treatment modalities, completion of the HPV vaccine series not only could prevent millions of cases of HPV infections, cervical cancer cases, and HPV-related deaths but could also decrease the economic burden associated with HPV-related diseases.

Conclusion

As the fourth-leading cause of cancer-related morbidity in the United States, cervical cancer is preventable through screening and HPV vaccination (ACS, 2017; Perkins, Lin, Silliman, Clark, & Hanchate, 2015; Van Dyne et al., 2018; Vu, Yu, Awolude, & Chuang, 2018). Screening through Pap testing is effective in detecting precancerous lesions; however, a high percentage of Hispanic women diagnosed with cervical cancer never had a Pap test (ACS, 2017; Kepka et al., 2015). Compared to

women from other racial and ethnic groups, Hispanic women tend to have the highest incidence of HPV-related cervical cancer (ACS, 2017). Currently, three HPV vaccines are available to girls as young as 9 years of age; however, compared to other developing countries and despite the recommendations of the ACIP, uptake of and completion of the HPV vaccine series is the lowest in the United States (Rahman, Hirth, & Berenson, 2017). The completion rate is even lower among Hispanic female adolescents (Jemal et al., 2013). Researchers have asserted that despite having the highest rate of initiating the HPV vaccine series, Hispanic female adolescents are less likely to complete the vaccine series (Chou et al., 2011; Jeudin et al., 2014; Niccolai, Mehta, & Hadler, 2011).

From a socioecological perspective, optimizing uptake of the HPV vaccine series by Hispanic female adolescents may require a concerted effort (Ferrer, Audrey, et al., 2015; Lanning et al, 2017). In this study I identified several factors that influenced the completion of the HPV vaccine series among Hispanic female adolescents. After controlling for maternal age, maternal education, family income, and health care providers' recommendation, the type of medical facility used to access health care was significantly associated with completion of the HPV vaccine series. Similarly, health insurance coverage and continuity in health insurance coverage were also significantly associated with completion of the HPV vaccine series. Gaps in insurance coverage did not adversely affect completion of the HPV vaccine series. However, despite the significance of the association between the type of medical facility used to access health care and health insurance coverage, the low rate of HPV vaccine completion noted in this study indicated that the overall impact of these factors on completion of the vaccine

series was relatively small. Therefore, although health insurance and a source of health care are essential to completing the HPV vaccine series, further research is needed to identify other modifiable contextual factors that may be more influential in completing the vaccine series.

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