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Parents' Decision Making and Uptake of Human Papillomavirus Vaccination Among Adolescent Males

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Walden University

College of Health Professions

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Franklyn Penn

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Walden University
2021

Abstract

Parents' Decision Making and Uptake of Human Papillomavirus Vaccination Among Adolescent Males

by

Franklyn Penn

MPH, American Military University, 2011

BSc Public Health, American Military University, 2009

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

Walden University

November 2021

Abstract

Human papillomavirus (HPV) infections account for most oropharyngeal, anal, and penile cancers among men. Two vaccines have been recommended for boys 11 years of age or older to prevent HPV infection, but HPV vaccination rates are far below the Healthy People 2030 target goal. Some research indicates the role of the parent is vital in HPV vaccine uptake, but to what extent is unclear. Through quantitative secondary data analysis of the National Immunization Survey-Teen 2016 (NIS-Teen) data set (n = 43,271) that was grounded in the health belief model, chi-square, and logistic regression analyses revealed three key findings. First, male adolescents whose mother was never married/widowed/divorced/separated/deceased/living with partner had higher odds of receiving HPV vaccines (OR: 1.27; 95% CI: 1.08 – 1.49, p = 0.003) than male adolescents with married mothers. Second, the association between maternal education level, poverty status of family, and HPV vaccination uptake by male adolescents was not statistically significant, and third, male adolescents whose parents had a positive attitude toward receiving vaccines had nearly 20 times higher odds of uptake of HPV vaccines compared to their counterparts whose parents had never taken them to receive tetanus booster shots, even after controlling for the marital status of mother and healthcare provider recommendation (OR: 1.42 vs. 0.07). The evidence presented in this study could be used to enhance educational programs for parents of male adolescents and healthcare workers, ultimately making a positive impact on social change by improving vaccination rates, increasing prevention of HPV, and reducing the overall incidence of HPV-related cancers in the United States.

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Dedication

To my beloved wife, Peggy, I dedicate my dissertation. My words are limited in expressing my thanks and gratitude for her continued support during what seemed to be an endless journey. To my children, Taj-Jaraad-(Marsha), Tjodi- (William Sr. [late]), and my grandchildren, William Jr., Taden, Jaraad, Trin, and Elijah (great-grandson), thanks for your understanding especially during my absences from many important events during my studies. Thanks also to my sister Jennifer during my many times of laments. Thanks to my late mother, Leonora, who believed in me and assured me I could do this and to never give up. To my late uncle Carl, my uncle Richard and my late aunts Emma Steven-Penn and Emelyn Perry-Penn, thanks for the many financial investments made in the foundation of my early educational goals. To my late cousins, Ernestine Thomas-George and Naomi Anthony-Rosan, for their support/encouragement and belief in me. Also, to my incredibly special cousin, Dr. Ingrid Dangleben, thanks for helping me to stay grounded. I salute you all with gratitude and love.

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To my Father God, I give praise and thanks for making my journey in this endeavor a success. To my family, I salute and acknowledge you for your endless support throughout what seemed to be a “sine fine itinere.” We made it! Without you, this milestone would not have been possible. Those of you who have rallied around me, I know you are happy for my accomplishments.

To my dissertation committee members, Dr. Aimee Ferraro, Dr. Wen-Hung Kuo, and my reviewer Mountasser Kadrie, you all have done it again! Through your compassionate guidance and understanding, you have helped in propelling me to this moment with your countless guidance and direction for which you all never seemed weary, especially my committee chair Dr. Ferraro who went above and beyond. I thank you!

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Chapter 1: Introduction to the Study

Introduction

Human papillomavirus (HPV) is a common virus that may ultimately lead to six types of cancers. The HPV vaccine is typically given at age 11 or 12 to protect children from developing these cancers (Centers for Disease Control and Prevention [CDC], 2019). HPV infections are so prevalent that almost all men and women contract at least one form of HPV (CDC, 2019). Currently, about 80 million Americans are infected with some type of HPV. Each year, about 14 million Americans, including teenagers, get infected. HPV is transmitted by close contact between the skin and tissue. HPV can be transmitted through vaginal, anal, or oral sex with someone who has the virus (CDC, 2019).

HPV vaccine uptake among male adolescents is traditionally very poor. Only 2% of male adolescents had received any dose of HPV vaccine 1 year after the vaccine was approved and first recommended for male patients (Reiter et al., 2011). Parents and sons registered moderate rates of acceptability for the vaccine, and the correlations illustrate potentially essential factors influencing their decisions on HPV vaccination. Future strategies are required to increase the acceptance and uptake of the HPV vaccine among male adolescents (Reiter et al., 2011). While HPV vaccine has been granted a permissive recommendation by the American Advisory Committee on Immunization Practices (ACIP) for male patients, private insurance currently offers coverage for about 65% of all male lives. Besides preventing HPV-related cancers and other malignancies, many factors deserve consideration for administering the HPV vaccine to male patients. With the low

intake among female patients, male patients vaccinating against HPV may reduce the risk of transmission from male to female (Healio, 2010).

However, studies on HPV knowledge among parents and male adolescents have shown that the general understanding of HPV, knowledge of HPV-related cancers, and knowledge of HPV vaccinations are affected by sociodemographic characteristics (McBride et al., 2017). The uptake of HPV vaccines is still well below articulated targets, particularly among those groups defined in this study as having a low general awareness of HPV (McBride et al., 2017). The HPV vaccine is a useful resource for cancer prevention and could be crucial to enhance awareness about HPV to increase vaccine uptake. Further work is required to explore the connection between sociodemographic characteristics, HPV awareness and knowledge, and vaccine uptake. Research examining knowledge of noncervical HPV-related cancers should be a priority given the importance of personal relevance in vaccine decision (McBride et al., 2017). In the same way, looking at gaps in HPV knowledge, there are still substantial differences in the complete comprehension of HPV vaccination by parents and children, gender preferences for vaccination, and guidelines from providers. To raise knowledge and understanding of HPV, the HPV vaccine, and HPV-related cancers, potential initiatives will address men and minority communities (Victory et al., 2019).

Concerning the relationship between parents' and other vaccine uptake and acceptance of the HPV vaccine, parents based their children's vaccination decisions on the availability and accuracy of information about the vaccine and the degree of trust in the vaccination provider and environment. Therefore, education in physician-to-parent

vaccines is essential, and assurances of adequate training in pharmacy immunization will ease fears among parents. Information will concentrate on cancer prevention attributable to the HPV vaccine, while, at the same time, allaying the concerns of parents about side effects and increased sexual activity gleaned from unreputable sources (Westrick et al., 2016). Knowledge of the benefits of the HPV vaccine could help enlighten parents and assist them in making an informed decision.

Parental sociodemographic variables, such as ethnicity and religion, are also strongly associated with acceptance of the HPV vaccine. HPV awareness is lower among ethnic minority women than among White women, and lower among non-Christian than Christian mothers. In a multinational review of parental attitudes about HPV vaccination, there was little difference between parental attitudes about vaccinating their daughters (70%) versus their sons (65%). The main reason parents refused to vaccinate their sons was that they did not believe their child would benefit directly from the HPV vaccine (Sudenga et al., 2011).

Problem Statement

HPV is one of the most common sexually transmitted infections (STIs) in the United States. HPV is a family of viruses that brings about cell changes in the epithelia, which can result in benign skin lesions, such as warts, which are local growth on the outer layer of the skin affecting both men and women. The virus is also responsible for affecting the skin and the mucous membrane (CDC, 2017). Although most men who acquire HPV may never develop any symptoms or health issues, other types of HPV can cause cancers of the penis, anus, or oropharynx (back of the throat to include the base of

the tongue and tonsils; CDC, 2017). HPV infections are on the rise in the United States, especially among young sexually active individuals (CDC, 2017).

HPV infections are so prevalent that individuals who are sexually active have a 75% chance of being infected with the virus at some point (CDC, 2017). Approximately 79 million Americans are infected with HPV, especially in their late teens and early 20s; also, there are many other conditions and cancers caused by different types of HPV in the United States (CDC, 2017). Thus, there is an urgent need for parents to be educated about the importance of getting their children the HPV vaccine. The rate of HPV infection in male adolescents is concerning due to the disease burden in men and its transmission to women (Palefsky, 2010). The reason the HPV vaccine is recommended for male adolescents is due to the many strains of HPV that bring about more severe health issues, such as penile cancer, oropharyngeal cancer, and anal cancer (CDC, 2017).

The ACIP advocates for the administration of the licensed quadrivalent HPV4 vaccine to male adolescents as a routine process before engaging in sexual activity (Allison et al., 2013). The application of the vaccine during that time frame (before the onset of sexual activity) will be an antecedent to the reduction of HPV infection (Donahue et al., 2015; Markowitz et al., 2014). When the efficacy of HPV vaccination is realized (through the channels of public policy reasoning and cost-efficacy outcomes), there will be an impetus for boys to receive the HPV vaccines in the same manner as girls before they have limited or no sexual activity (Palefsky, 2010).

Several studies have shown that the uptake of the HPV vaccine for male adolescents is associated with healthcare provider recommendation (Allison et al., 2013),

parents who have reported receiving a vaccine recommendation from healthcare personnel (American Academy of Family Physicians [AAFP], 2019), and perceived spousal agreement (Rickert et al., 2014). Also, improved provider–specific educational interventions contribute to the improvement of providers' knowledge, which contributes to increasing HPV vaccine uptake (National Center for Biotechnology Information [NCBI], 2019). However, Rickert et al. (2014) also found that while more than half of parents in their study reported intent to vaccinate against HPV, only 28% of male children received their first dose. This finding indicates that unknown factors impact parental decision making and intention to uptake the HPV vaccine. This study will fill a gap in the literature by examining factors that have not been previously studied. Furthermore, the relationship among factors such as the uptake of other vaccines like for tetanus, diphtheria, and pertussis (Tdap), decision making, parents' demographics (race and educational level) has not yet been clarified, making it unclear which is dominant.

Purpose of the Study

The purpose of this study was to examine the relationship between parents' decision making and the uptake of the HPV vaccine among their adolescent male child. More specifically, in this study, I sought to determine whether there is an association between the uptake of other vaccines and parents' demographics and uptake of the HPV vaccine among their adolescent male child. I used a large secondary data set to evaluate the role of parental factors as they relate to vaccination of male adolescents in the United States.

Research Questions and Hypotheses

In this study, I examined two research questions:

RQ1: Is there a relationship between parental demographics, such as race, ethnicity, and education level, and the uptake of HPV vaccines for their adolescent male child?

$H_0$1: There is no statistically significant relationship between parental demographics and the uptake of HPV vaccines for male adolescents.

H_a1: There is a statistically significant relationship between parental demographics and the uptake of HPV vaccines for male adolescents.

RQ2: Is there a relationship between parental decision making regarding vaccines as measured by uptake of other vaccines (Tdap) and uptake of HPV vaccines for their adolescent male child, after controlling for race, ethnicity, and education level?

$H_0$2: There is no statistically significant relationship between parental decision making regarding vaccines as measured by uptake of other vaccines (Tdap) and uptake of HPV vaccines for their adolescent male child, after controlling for race, ethnicity, and education level.

*H*a2: There is a statistically significant relationship between parental decision making regarding vaccines as measured by uptake of other vaccines (Tdap) and uptake of HPV vaccines for their adolescent male child, after controlling for race, ethnicity, and education level.

Theoretical Framework

The theoretical framework for this study was Rosenstock's (1974) health belief model (HBM), which is a psychological model used to explain and forecast outcomes of health behavior by focusing on the attitudes and beliefs of individuals. HBM was originally formulated to model the adoption of preventive health behaviors in the United States and was successfully adapted to fit various cultural and topical contexts (Griffin, 2012; Scarinci et al., 2012; Jones et al., 2014).

HBM is comprised of four constructs representing perceived threat and net benefits: (a) perceived susceptibility, (b) perceived severity, (c) perceived benefits, and (d) perceived barriers. These concepts were proposed as accounting for people's readiness to act (Jones et al., 2015). An added concept, *cues to action*, would activate that readiness and stimulate overt behavior. A recent addition to the HBM is the concept of self-efficacy or one's confidence in the ability to successfully act. This concept was added by Rosenstock et al. in 1988 to help the HBM better fit the challenges of changing habitual unhealthy behaviors, such as being sedentary, smoking, or overeating (Jones et al., 2015).

Nature of the Study

The nature of this study was quantitative, involving secondary data analysis of the National Immunization Survey-Teen (NIS-Teen) data set (CDC, 2018). The independent variables were parental decision making to uptake other vaccines, such as Tdap, and parents' demographics, such as race and level of education. The dependent variables were the intention to uptake the HPV vaccine within the next 12 months. Ordinal regression

was used to assess the relationship between the independent variables and the dependent variables. The research is discussed further in Chapter 3. The HBM was used to guide this study through the idea that people typically make an effort to take the necessary actions to prevent themselves from being susceptible to a condition that can bring about potentially serious consequences, especially when there are minimal barriers required for behavioral action that will be beneficial and are cued to take part in the required action (Chen et al., 2011).

Definitions

Anal cancer: HPV infection is the principal risk factor for anal cancer (CDC, 2019).

Anogenital: Regarding the anal and genital areas (Venes & Taber, 2005).

Cervarix: In 2009, the second HPV vaccine was released in the United States. The Cervarix vaccine is effective against HPV Serotypes 16 and 18 (CDC, 2010).

Cervical cancer: This is a type of cancer that starts in the cervix-lined cells. Higher uteral part (American Cancer Society, Inc., 2014). Cervical cancer is the world's second most common female cancer, with almost 500,000 cases in 42 years leading to > 250,000 deaths annually (Union for International Cancer Control, 2015).

Education: The level of education reported by the participants in the 2014 NIS-Teen survey (CDC, National Center for Immunization and Respiratory Diseases, & National Center for Health Statistics, 2015).

Ethnicity: The NIS-Teen Survey for 2014 describes ethnicity as participants of Latin or non-Latin American origin (CDC, National Center for Immunization and Respiratory Diseases, & National Center for Health Statistics, 2015).

Gardasil: The first HPV vaccine in the United States released in 2006. The Gardasil vaccine is effective against HPV Serotypes 6, 11, 16 and 18 (U.S. Food and Drug Administration, 2013).

HPV vaccine: There are two vaccines to avoid chronic infection oncogenic HPV strains. One vaccine is effective against four HPV strains, two high risk and two low risk, and both vaccines are effective in protecting against forms that cause 70% of cervical cancers (CDC, 2013; U.S. Food and Drug Administration, 2013).

Human papillomavirus (HPV): The most common sexually transmitted genital infection (CDC, 2014). HPV strains that are nononcogenic or low risk can cause genital warts, whereas oncogenic or high-risk HPV can cause cervical cancer (Hariri et al., 2011). More than 100 types of HPV are known, and there are over 40 types of HPV that can invade the genital region (Hariri et al., 2011). HPV types are categorized according to cancer organization.

Oropharyngeal cancer: The most common sexually transmitted disease, oral HPV, may cause cancers in the back of the throat (CDC, 2016).

Penile cancer: Typically occurs on or below the prepuce. HPV causes about one third of cases of penile cancer (CDC, 2019).

Race: The NIS-Teen Survey 2016 describes race as Hispanic, non-Hispanic White only, non-Hispanic Black only, non-Hispanic other and multiple races (CDC, 2016).

Assumptions

Several assumptions were used to base this study. The most important assumption was that the data collection instrument was accurate and reliable based on the prior use of the HPV vaccination research survey. The NIS-Teen, introduced in 2006, offered the most recent estimates of vaccine coverage among children and adolescents using a common survey methodology (CDC, 2016). Furthermore, it was hypothesized that surveyors collected data in an impartial way and the participants gave the most truthful and precise answers to question. At the time of the study, the target group for the NIS-Teen was teenagers ages 13–17 who lived in U.S. households.

The questions in the NIS-Teen survey were considered to be accurate and relevant information-gathering methods. This assumption was based on the CDC's usage of many years and several studies released earlier. These assumptions were important for this research to be carried out using this secondary source of data. Because of the National Immunization Survey's (NIS) multiyear data set, this data source was believed to be accurate and reliable for use in this study. These assumptions are essential to the study and data analysis given so that conclusions can be drawn about the population surveyed.

Scope and Delimitations

There is a disparity in the literature as to the parental expectations for HPV vaccination of male children. These survey data were restricted by the recollection of information from the parents who took part in the study. For the 2016 NIS-Teen, the survey population studied might not be generalizable to other populations. Furthermore, the eligibility of the survey participants was determined by self-reporting by random digit

dialing phone interviews by parents or guardians of adolescent children ages 13–17 years at the household. The NIS-Teen is a broad representative national sample measuring the vaccine coverage for the 50 U.S. states (CDC, 2016).

Generalizing the results to other vaccines is difficult. These survey data were restricted by the recollection of information from the parents who took part in the study. For the 2016 NIS-Teen, the survey population studied might not be generalizable to other populations. The eligibility of the survey participants was determined by self-reporting by random digit dialing phone interviews by parents or guardians of adolescent children ages 13–17 years at the household.

Limitations

This study's limitations are mainly related to the NIS. The NIS has a few primary benefits, such as being a nationally representative annual data set that tracks 19- to 35-month-old children's vaccine coverage, and the data set is publicly accessible from the CDC. The data set, however, has some limitations regarding the lack of measures on the health status of both children and parents/guardians, vaccination intentions, and perceptions of vaccines.

The internal validity of the study data is supported by the random selection of NIS-Teen samples using U.S.-wide landline and cell phone numbers, the application of sampling weights, and the validation of both NIS-Teen and the Social Vulnerability Index instruments and results (Brewer, 2004; Flanagan et al., 2011; Reagan-Steiner et al., 2016). The national sample set and real-world observation support the external validity of the study data, rather than a laboratory setting (Ondercin et al., 2004). Nevertheless,

limitations hinder the ability to draw causal inferences and generalize the results to the entire U.S. population. Overall, there may be unknown confounders affecting the relationship between the independent and dependent variables; these may be obscured by aggregate data, not currently observable, or be in flux within dynamic processes affecting health and health outcomes.

The NIS-Teen survey is cross-sectional, enabling inferences to be supported but not causal. NIS-Teen household response rates vary from year to year, with roughly 60% and 31% response rates for landline and cell phones, respectively, in 2014 (compared to 56% and 30% in 2015), and roughly half of respondents had adequate provider data (Reagan-Steiner et al., 2015; Reagan-Steiner et al., 2016). The chances for estimates to be biased can be realized due to errors in respondent recall, nonresponders, or small sample sizes in specific variables or selected local areas (Reagan-Steiner et al., 2015).

Significance

In the United States, approximately 34,000 HPV-related anogenital and oropharyngeal cancers are diagnosed annually, which results in an estimated cost of $8 billion per year in medical expenses (Du et al., 2015). The results of this study may elucidate factors that can increase the uptake of the HPV vaccine among male adolescents and contribute to saving lives and helping to reduce the financial burden through the prevention and treatment of HPV-related diseases. Du et al. (2015) noted that "HPV vaccination would be cost-effective for reducing HPV-related diseases in both women and men with assumed 75% vaccine coverage and completion rates for pre-adolescent girls." In the Healthy People 2030, the national objective for HPV is to reduce

the percentage of U.S. children receiving zero doses of prescribed vaccines by 2 years of age. Therefore, the results of this study can also be used to guide effective strategies to increase HPV vaccination among male adolescents and, thereby, establish herd immunity in which HPV infections among women will reduce.

Summary

Improving HPV vaccination rates among male adolescents is a social problem that needs addressing. The protection afforded by the HPV vaccine will protect both patients and partners. Therefore, there is a need for research in this area to bring awareness among parents and their adolescent male to begin filling the gap through the availability of correct information needed to demonstrate the importance of the uptake of the HPV vaccine among male adolescents. In the following chapter, I provide a summary of the literature to emphasize the significance and relevance of this research project and add to the current knowledge base. I present an exhaustive review of the current literature, current vaccine hesitation, literature search strategies, the theoretical basis supporting and guiding this study, key concepts related to this study, and a summary and conclusions.

Chapter 2: Literature Review

Introduction

The purpose of the study was to examine the relationship between parental factors (demographics and decision making) and uptake of the HPV vaccine among male adolescents. This chapter begins with an explanation about how the literature was searched and selected. Next, there will be a discussion of HBM and how it relates to this study. Topics are organized as follows: (a) prevalence of HPV in the United States, (b) HPV conditions among male adolescents, (c) male adolescents and HPV-related cancers, (d) HPV knowledge among parents and male adolescents, (e) gaps in HPV knowledge, (f) parents' attitudes toward vaccines in general, (g) the acceptance of the HPV vaccine and vaccine uptake, (h) parents' socioeconomic status and other sociodemographic information and their acceptance of vaccines in general, and (i) parents' sociodemographic information related to the uptake of the HPV vaccine their adolescent male children.

Literature Search Strategy

A comprehensive review of the literature was carried out to understand the relationship between parents' decision making and uptake of the HPV vaccine among male adolescents. The databases used in the search for the relevant literature included PsycINFO, Google Scholar, EBSCOhost. CINAHL, PubMed, PsycINFO, Health Source: Nursing/Academic Edition, and Walden University Library. The following search terms were used in combination to find peer-reviewed articles about the relationship between parents' intention and the uptake of the HPV vaccine among male adolescents: *parents'*

HPV vaccine, parents and vaccine intent, HPV-related cancers in American men, reason HPV vaccine is recommended, number of HPV-related cases diagnosis in the United States, HPV vaccines for men, HPV surveys, recommendation of HPV vaccine in adolescent males, parents' reasons about HPV vaccine to their children, HPV diseases vaccine acceptance/barriers, parental attitudes towards male HPV vaccine, and *HPV vaccine acceptance among African American young me*n.

Articles intended to be used in this research were those with a publication date of no earlier than 5 years and only using those that were more relevant in support of the study (historical purpose). In some instances, many studies were included as they related to the topic of study. Upon completion of the articles search, approximately 59 articles where studies were conducted ranging from 1992 to 2020 were from Africa, Canada, Caribbean, Europe, and the United States and were significant in providing evidence in favor of the research.

Theoretical Foundation

The Health Belief Model

The theoretical framework for this study is Rosenstock's (1974) HBM, which is a psychological model used to attempt to explain and forecast outcomes of health behavior by focusing on the attitudes and beliefs of individuals. As one of the most commonly developed health behavior theories (Glanz & Bishop, 2010), the HBM suggests that six frameworks predict health behavior: (a) vulnerability to danger, (b) seriousness of danger, (c) advantages to action, (d) obstacles to action, (e) self-efficacy, and (f) signs to action (Becker, 1974; Champion & Skinner, 2008; Rosenstock, 1974). The HBM was

originally formulated to model the adoption of preventive health behaviors in the United States and was successfully adapted to fit various cultural and topical contexts (Griffin, 2012; Scarinci et al., 2012; Jones et al., 2015).

The HBM is comprised of four constructs representing the perceived threat and net benefits: (a) perceived susceptibility, (b) perceived severity, (c) perceived benefits, and (d) perceived barriers. These concepts were proposed as accounting for peoples' readiness to act (Jones et al., 2015). An added concept, *cues to action*, would activate that readiness and stimulate overt behavior. A recent addition to the HBM is the concept of self-efficacy or one's confidence in the ability to act successfully. This concept was added by Rosenstock et al. in 1988 to help the HBM better fit the challenges of changing habitual unhealthy behaviors, such as being sedentary, smoking, or overeating (Jones et al., 2015). The HBM guided this study through the idea that people typically make an effort to take the necessary actions to prevent themselves from being susceptible to a condition that can bring about potentially serious consequences, especially when there are minimal barriers required for behavioral action that will be beneficial, and are cued to take part in the required action (Chen et al., 2011).

Following are reviews of some studies in which the HBM was applied that resulted in positive outcomes: Scherr et al. (2017) stated that promoting vaccination at some stage in pandemics is paramount to public health, yet few researchers had examined theoretical motivations for vaccination at some stage in pandemics. Thus, the relationships between dispositional pandemic worry, constructs of the HBM, and vaccination during the H1N1 pandemic were studied. In this study, a total of 1,377

participants completed surveys assessing dispositional pandemic worry, HBM variables, and H1N1 vaccination. Principle axis aspect analysis and point biserial correlations were conducted. Differences in fear and vaccination were assessed with the aid of impartial samples t-tests. Relationships between vaccination, demographics, and fear were investigated using hierarchical linear regression. PROCESS analysis was conducted to explicate the relationship between fear and vaccination intention (Scherr et al., 2017).

The result of this study was a two-factor shape of dispositional pandemic worry frequency, and fear severity was confirmed. Dispositional fear used to be higher among those who intended to and acquired the H1N1 vaccine. Worry frequency and fear severity were positively related to vaccination. Threat, advantages, and barriers mediated the influence of worry severity and hazard, and barriers mediated the influence of fear frequency on vaccination intentions. Researchers found that messages increasing dispositional fear and advantages while reducing limitations may also increase vaccination conduct at some stage in a pandemic event. However, future studies of relationships between dispositional fear and HBM variables are warranted (Scherr et al., 2017).

In another study conducted in France, Fall et al. (2018) noted that seasonal influenza is common among students and regularly responsible for impaired educational performance and decreased tiers of everyday health. However, the vaccination level in this population is very low. As the seasonal influenza vaccine is now not compulsory in France, it is essential to improve the vaccination uptake through identifying predictors of both intention and behavior (Fall et al., 2018).

Fall et al. (2018) investigated the impact of decisional balance, motivation, and self-efficacy on vaccination acceptance and the use of the extended HBM and self-determination theory. In the design and main outcome measures, university college students were invited to complete an online survey to answer questions about their influenza vaccination intention and HBM and self-determination theory constructs. Also, a 1-year longitudinal follow-up study was conducted to learn about investigated vaccination behavior. In the results, researchers found that the autonomous motivation and self-efficacy appreciably influenced the intention to have the influenza vaccine, and vaccine behavior at 1-year follow-up intervals (Fall et al., 2018). Intention envisioned a significant percentage of variation (51%) in behavior and mediated the impact of these predictors on vaccination behavior (Fall et al., 2018). In conclusion, Fall et al.'s results endorse that motivation ideas of the self-determination theory can be adequately blended with the HBM to understand vaccination behavior.

Finally, Magaji et al. (2016) discussed the HBM as a framework for bringing about awareness for the reasons behind the objection of immunization information by parents of children under 5 years of age. Magaji et al. mentioned HBM as a framework for exploring the reasons behind objection of immunization facts by parents of children under 5 years of age. The researchers discussed how the first four constructs of the model perceive seriousness, susceptibility, advantages, and limitations are applied in perception of health-associated problems (Magaji et al., 2016). Additionally, Magaji et al. discussed how these constructs will help in understanding the reasons for rejection of immunization data by parents of children under 5 years of age.

In the next section, I summarize what is known about the relationship between parents' intention and uptake of the HPV vaccine among male adolescents as related to the independent variables in this study, including parental intention on the uptake of other vaccines, the relationship of parents' SES, with the dependent variables being the uptake of the HPV vaccine among male adolescents.

Literature Review

Prevalence of HPV in the United States

HPV is one of the most common STIs in the United States. HPV is a family of viruses that brings about cell changes in the epithelia, which can result in benign skin lesions, such as warts, which are local growths on the outer layer of the skin that affect both men and women. The virus is also responsible for affecting the skin and the mucous membrane (CDC, 2017). Although most male adolescents who get HPV may never develop any symptoms or health issues, other types of HPV viruses can cause cancers of the penis, anus, or oropharynx (back of the throat to include the base of the tongue and tonsils; CDC, 2017). HPV infection is on the increase in the United States, especially among young sexually active individuals (CDC, 2017).

In the United States, approximately 33,200 HPV-related cancers are reported annually, and the HPV virus is responsible for more than 90% of cervical and anal cancers, 70% of vulvar and vaginal cancers, and more than 60% of penile cancers (CDC, 2014). ACIP in 2009 provided guidance for the administration of the HPV4 vaccine to male patients 9 through 26 years old, with special emphasis that men who copulate with men are at a higher rate of risk for contracting HPV infections (Lu et al., 2015). Two of

the recommended vaccines—Gardasil (HPV vaccine quadrivalent) and Cervarix (HPV bivalent [Type 16 and 18] vaccines recombinant—are capable of protecting against the HPV virus (National Cancer Institute, 2019).

Approximately three quarters of adults will be infected with the HPV virus during their lifespan; HPV is most common among the young sexually active population, and due to its prevalence, HPV can impact morbidity and mortality rates (Cox, 2006). In countries with limited screening, the rates of mortality from cervical cancer supersedes that of HPV in men, but in developed countries, HPV-related cancers in men, such as anal, penile, and oral cancers, are in concert with that of cervical cancer in women (Palefsky, 2010). Prolonged infections consisting of high-risk HPVs can cause cancer in areas of the body infected with the HPV—for example, in men, the throat, back of mouth to include the soft palate, the base of the tongue and tonsils (oropharyngeal cancers, 70%), rectum, anus, (anal cancer, 90%), and penis (penile cancer, 60%; National Cancer Institute, 2018).

In one of the first nationally representative studies of genital HPV occurrence among adolescent and adult men, Gargano et al. (2017) obtained data from the first cycle on National Health and Nutrition Examination Surveys (NHANES, 2013–2014), resulting in the discovery of the prevalence of genital HPV DNA in men. Among the age group of >25 years, approximately 50% of the HPV was not found and about 1 in 4 had a detectable high threat HPV (HR-HPV; Gargano et al., 2017). However, males in the United States during the period 2013–2014 had a 42.2% rate of HPV infection, which was in consort with the prevalence of cervicovaginal infection noted in U.S. female

adolescents (42.5%; Gargano et al., 2017). Data revealed high prevalence of HPV in young adulthood and lower prevalence in older ages, whereas it was found that the prevalence of HPV and HR-HPV attain high levels in young adult men and remained at the same rate in older age group though 59 years (Gargano et al., 2017). Benefits were derived from the vaccination program as there was an impact on the prevalence of HPV Types 6, 11, 16, and 18 among men, which was found among the differences in age-specific prevalence 4vHPV (quadrivalent HPV vaccine type) and non-4vHPV. Before the vaccination program, 42.2% of U.S. men between ages 14 and 59 were found to have detectable HPV infections (Gargano et al., 2017).

HPV has no regard for class or races; it is an equal opportunity pathogen and relates to the human condition, it (HPV) is a social disease, and an agent of affliction to the human species is highly infectious. However, the HPV vaccine continues to be safe and thereby, allowing for long-term durability of protection (Bosch et al., 2014). Furthermore, it is of importance for societies to acknowledge the reality of HPV, its prevalence and unavoidability of infection, and be more conscious of the significance of the virus as a precursor to carcinoma with the understanding that HPV is a leading preventable cancer which can be reduced through HPV vaccination (Bosch et al., 2014). Also, a study has indicated male HPV vaccination is very effective in preventing HPV transmission and prevention of cancer in both men and women than was previously thought (Han et al., 2017).

HPV Conditions Among Male Adolescents

As HPV infection and its effects prevail globally as a continuous public health threat, the adolescent population continues to be affected to a great extent (Walhart, 2012). Despite the effectiveness of the HPV vaccine to reduced genital warts and possible invasive cancers, men's understanding and interest in prophylactic vaccination and HPV risk remains low (Lopez et al., 2010). The CDC, (2016) as per the updated recommendation of the ACIP and Morbidity and Mortality Weekly Report (MMWR) December 2016, recommended guideline is for the administration of two doses of HPV vaccine for 11-12 years old instead of the previously recommended three doses with administration (6-12 months after the first dose) which will protect against cancers caused by HPV. Furthermore, of the approximately 100 types of HPV infection, 40 are known to infect the genital area, and some infection can run a definite and limited course, thereby becoming asymptomatic and unrecognized (CDC, 2016).

However, most sexually active persons have a chance of being infected with the HPV virus at least once during their lifetime. The types of infections include oncogenic infection by the high-risk HPV infection (e.g., HPV 16 and 18) responsible for cancers, and the low-risk HPV infections (e.g., HPV type 6 and 11), which are responsible for genital warts and recurring respiratory papillomatosis (CDC, 2016). There remains in the United States a substantial burden of cancers and anogenital warts related to HPV infections (CDC, 2016). Although it is estimated that adolescent between the age of the 15-24 old represents 25% of the sexually active population, they encounter higher rates of new STIs. The higher risk of infection is due to a combination of other behavioral

influences, which depicts numerous barriers to obtaining STI prevention means and other contributing factors such as parental acceptance of STI vaccinations and other social concerns (Walhart, 2012).

The rate of oropharyngeal (throat cancer) and anal cancer, which is now surpassing cervical cancer, continue to rise in the United States with an annual rate of approximately 18,226 cases annually, which are most likely caused by HPV. Also, oropharyngeal cancers are more dominant among men than women for example, some oropharynx cancers (back of the throat including tongue base and tonsils) were related to HPV. Approximately, 3,500 new cases of HPV-associated oropharyngeal cancers are diagnosed in women and approximately 15,500 in men are diagnosed in the United States each year. These figures are based on cancers in particular areas of the oropharynx and do not include cancers in all regions of the head and neck or oral cavity. Non-Hispanics and men suffer more often from these cancers than Hispanics and women (CDC, 2019).

Lopez et al. (2010) noted an estimate of over 40% of penile cancers caused by HPV, as well as a 29%–82% of penile tumors depending on how histopathologic type is reported among Hispanic men from Brazil, Mexico, and the United States (including Puerto Rico) during the period 1992-2004. Also, the most common genotype found in penile squamous cells are oncogenic HPV 16 and 18. In this study, among 1,200 men from Brazil, Mexico, and the United States, it was found that anal cancers caused by HPV were reported among men who reported only heterosexual activities (Lopez et al., (2010).

In another study, Johnson, et al. (2017) noted that “the rate of HPV vaccination is the least administered vaccine compared to other adolescent vaccines. More alarmingly, the rate is lower for boys as compared to girls. Also, the factors associated with HPV vaccination were different for male adolescents and female adolescents. Provider recommendation for the HPV vaccines is the strongest predictor of immunization for teens of both genders; however, provider recommendation itself is insufficient to achieve high coverage rates, especially among males” (p. 8).

Male Adolescents and HPV-Related Cancers

Over the last two decades, great strides have been demonstrated in the advancement of cancer research, where it was discovered that HPV has contributed to the cause of cervical cancer (Healio, 2010). Furthermore, of the 120 HPV types which have been identified, approximately over 50% of sexually active individuals may be infected with HPV in their lifetime. Also, male adolescents will encounter HPV-associated genital lesions that can present an eminent burden not only to themselves but their counterpart (female adolescent) also their female sex partners (Healio, 2010). More importantly, administering the vaccine (HPV) to male adolescents can paved the way to help to reduce male-to-female transmission (Healio, 2010).

HPV infection, which can lead to specific types of cancer, not only affect women, since 4 out of every 10 cases of HPV infection occur in men, which results in approximately 14,000 cases (in men) in the United States annually (CDC, 2019). Also, at present, it is not possible to determine if people with HPV will develop cancer and other health-related issues, and individuals with weakened immune systems such as HIV/AIDs

would be more vulnerable to HPV and other underlying health issues (CDC, 2109). HPV is the most prevalent sexually transmitted disease in the United States, with more than 40 HPV types that infect the genital areas of men and women. HPV is divided into two types of cancer-causing “low risk” and “extreme risk,” based on the result in the person at risk of cancer (CDC, 2019). According to the

International Agency for Research on Cancer, it has been found that of the 13 forms of HPV cancer that cause cancer of the penis, anus and vulva, common head and neck cancers such as oropharynx and other immediate areas may be included. However, it must be noted that HPV infection can go unnoticed, which at times can be asymptomatic in men (CDC, 2018).

Although HPV is related to causes of cervical cancer in women, boys are often carriers of the virus. Over the recent decade, an increase in HPV associated tonsillar and base of the tongue squamous cell carcinoma have been reported. Furthermore, the HPV vaccine will be a barrier in preventing the increase of those HPV-related diseases not only in the population at large but also in helping others from contracting HPV-related diseases (Grandahl et al., 2018). One of the challenges with HPV-related diseases confronting men is their latency, where one may be the carrier of the virus while not displaying any sign of the disease or infection, thereby causing a delay in receiving treatment or diagnosis. Also, at times undeveloped HPV symptoms may not be identified (Palesfsky, 2007). Other complexities are encountered, such as penile and anal cancers though relatively rare in North America (Palesfsky, 2007).

The mortality rate for cervical cancer in women in countries with limited screening outnumbered the mortality rate of HPV-related diseases in men, whereas, in the developed countries, cancer mortality (for HPV related cancer) is about the same as cancer mortality in women. HPV in men adds to their morbidity due to the development of condylomata acuminate (genital warts), and can contribute to increased morbidity and mortality in women through sexual transmission (HPV) (Palefsky, 2010). Given the limited knowledge of HPV infection in men and its serious clinical implications in comparison to cervical HPV infection in women, it is of importance to administer the highly efficacious HPV vaccine to both women and men (Palefsky, 2010).

In the United States, the incidence of HPV-related anal cancer continues to rise from a low of 0.5 per 100,000 in 1974 to 1.3 per 100,000 in 2004 (Healio, 2010). Also, Anogenital HPV-associated cancer in men was found to be diagnosed more frequently. The incidence of anal cancer can be equal to that of cervical cancer among the general population of women in the United States prior to the use of cervical cytology screening among men having sex with men. Concerning the preceding, the risk of acquiring HIV infection in men may increase (Healio, 2010).

Due to the limited access to primary care and their unwillingness to share their sexuality, the preponderance of sexually transmitted diseases (STDs) is high among African American male adolescents having sex with male adolescents. HPV remains the most prevalent STD among the more than 40 various serotypes that lead to anal/genital warts to include oral and genital cancers (Onyeabor et al., 2014). Taken prior to becoming sexually involved, the HPV vaccine serves a prophylactic purpose in

adolescent. The rates of HPV vaccination among adolescents of some minority and underserved areas is disappointing as they are found to encounter the HPV virus at a disproportionate rate compounded with certain male-specific cancers (Onyeabor et al., 2014).

HPV Knowledge Among Parents and Male Adolescents

Despite an abundance of research and data about the low rate of uptake of the HPV vaccines in male adolescents and their counterparts, little is known about the relationship between parents' intention and the uptake of the HPV vaccine in their adolescent male child. A large sample of African American parents was studied to determine vaccine acceptability of their daughters with regards to parents' HPV knowledge in consort with their socio-cultural concepts and their intention of the uptake of the HPV vaccine (Thompson et al., 2012). The result of that study showed that although parents knew about the HPV vaccine and the derived benefits, pediatrician recommendation played a significant role. Furthermore, parents' intention for uptake of HPV vaccine in their adolescent male children can be positively impacted due to their trust in healthcare providers which is similarly related to uptake of childhood vaccines; therefore it is of importance for there to be effective communication about HPV among providers supporting parents positive beliefs about the effective outcome of the vaccine as well as helping parents to understand why the HPV vaccine would benefit their children (Newman et al., 2018).

Over a decade ago, following the discovery that HPV is linked to cervical cancer, several types of research on the epidemiology, pathogenesis, and therapeutic processes of

HPV had been noted in the scientific literature (Fernandez-Esquer et al., 2000). Also, there is the concern of the burden of male HPV infection, which is an added risk for transmission to female adolescents, compounded with the variety of other HPV related cancers in men such as anal, penile, and oral cancers in particular among immunocompromised male adolescents as a result of HIV infections (Palefsky, 2010). The results from a cross-sectional survey of HPV knowledge and awareness among college students at a public university in South Carolina found the existence of a knowledge gap about HPV infection, in particular, a large percentage of students accounting for the unawareness of men's vulnerability for negative HPV results. Such results attest to the fact why HPV is still on the increase despite the availability of an effective vaccine (Kasymova et al., 2019). Also, despite a high level of awareness of HPV in the study mentioned above, there were several gaps identified in knowledge among this population (college students) similar to previous research. For example, many students perceived their risk for HPV to be low, and young men were less knowledgeable of HPV in comparison to their counterpart (Kasymova et al., 2019).

In several other studies, it has been noted that parents tend to show different areas of concern regarding their understanding of HPV benefits for boys, such as some parents are concern about the protection of their sons against cancer, and other parents concern about protection from genital warts (Lacombe-Duncan et al., 2018). However, the lack of knowledge and awareness among parents and boys, as well as the need to be educated about the HPV vaccine and the benefits to be derived, continues to be common barriers for accepting the vaccine (Lacombe-Duncan et al., 2018). Also, the adolescent population

is disproportionately affected as HPV infections continue to be a public health and global concern (Walhart, 2012). Over time, parents' interaction between vaccination convictions and social expectations and their decision to vaccinate plays a critical role in transforming their interaction in a positive way with their adolescent male child's acceptance of HPV vaccines (Schuler et al., 2015).

In another study on attitudes towards and knowledge about HPV and the HPV vaccination among parents of teenage boys in the United Kingdom, it was found that parent's knowledge was poor about the consequences of HPV for male adolescents compared to their knowledge of impact of HPV on female health (Sherman, 2018). Furthermore, it is believed should parents become more knowledgeable; more parents would opt to have their sons vaccinated from the standpoint of health equality (Sherman, 2018). The need for awareness and knowledge of HPV and HPV-related diseases continues to rise for male adolescents. At the same time, evidence has shown that the use of the HPV vaccination with male population will help to reduce the incidence of HPV-related cancers (King et al., 2015). Although knowledge of HPV among male adolescents was low, once educated about the prevalence and the consequences of infection, their attitude and intention to accept the vaccination change from moderate to favorable among that population (Gutierrez et al., 2013).

In other findings from research investigating parental acceptance of HPV, Lenselink et al. (2008) studied a sample of parents of children aged 10-12 years of age with regards to the acceptance of HPV vaccine for their children and their knowledge of HPV and cervical cancer. The study showed that HPV vaccination would be accepted by

88% of the parents during the onset of adolescents, and those parents of children who participated in the immunization of the National Vaccination Program accepted the HPV vaccine significantly more. Also, in an earlier study by Olshen et al., (2005) on parental acceptance of the HPV vaccine, several parents were in favor of the administering of the HPV vaccine to both boys and girls, and the importance of boys receiving the HPV vaccine to protect future partners by reducing disease transmission. Furthermore, it was found that parents with a positive outlook who felt that their children could be at risk for HPV despite their (parents') poor awareness of the vaccine effectiveness and outcome as per the HBM, were likely to have their children vaccinated (Olshen et al., 2005). Although parents realize the benefit of the male HPV4 vaccine for their adolescent male child, the HPV vaccination rate remains low (Nanagas et al., 2016).

Despite the availability of the HPV vaccine, its acceptance remains low, especially among male adolescents due to the vulnerable and low-income populations who continue to have limited access and knowledge of the benefits. Such evidence was found in a survey carried out in Rhode Island to ascertain knowledge, attitude, and practice (KAP); also, an educational intervention through a brief video which results indicated that parents will be intentional about uptake of HPV vaccine in the children should they be more aware (Chau et al., 2014).

Furthermore, the results of a quantitative study carried out by Krawczyk et al., (2013) that sampled total of 128 college male adolescents to assess their knowledge about HPV and their intent to receive the vaccine was accomplished through the use of a questionnaire. An assessment of their (128 college male adolescents) demographics,

health, knowledge of HPV and HPV vaccine were assessed. Findings from the study showed that 83% reported sexual activity, with the average age of participants reporting the onset of sexual activity at 17 years. The result of the survey indicated that most participants knew about HPV and the HPV vaccine. However, about half of the participants had expressed they may not receive the vaccine (Krawczyk et al., 2013).

Schuler, DeSousa, and Cayne-Beasley (2014) sought to identify characteristics of parents likely to consider their children future partner's protection in vaccine decisions and to determine if parents likely to consider partners in vaccine decisions had greater intention to vaccinate. This study relates to my dissertation topic as it will help to shed light on reasons why parents' may allow their adolescent male children to receive the HPV vaccine. Also, Dayal et. al. (2017) explored the predictors of human papillomavirus (HPV) vaccine uptake or intent among parents of pre-adolescents and adolescents.

Based on the use of the HBM, it was evident that providers' advice for HPV vaccination and perceived HPV vaccination harm had a statistically significant direct effect on HPV vaccine uptake or intent. Targeted education to improve parental HPV awareness, along with parental empowerment to promote an equitable relationship with providers, can persuade them of the effectiveness of the HPV vaccine. This, in turn, may help them put the perceived harm to the HPV vaccine into proper perspective and allow them to make informed decisions about their children's timely HPV vaccination. Because provider recommendation is one of the most important contributing factors for taking or intending to take up HPV vaccines, parental education and healthcare providers (HCP)

recommendations will help to reduce knowledge gaps and empower parents to make timely decisions about vaccinating their children (Dayal et al., 2017).

Gaps in HPV Knowledge

Of public health concern is the low vaccination rates of HPV. The ongoing situation stems from several barriers to include parents' behavior and understating about the vaccine compounded by knowledge gaps, insurance coverage and other financial issues, and most importantly the lack of HCP recommendation and support about the appropriate time to begin vaccination of the young adolescent (Espinoza et al., 2017). Given that the HPV vaccination was initially geared towards the prevention of cervical cancer, and the perception of HPV is a disease that manifests only in girls contributed to the low vaccination rate in male adolescents. HPV infection is responsible for 96% to 99% of cervical cancers in women in comparison to 12% to 63% of oropharyngeal cancers and 36% to 40% of penile cancers in men. Therefore, cancer in men can be caused through other means, such as the misconception of the HPV vaccine and its effectiveness in male adolescents. Also, it is important to note that the HPV vaccine will not only prevent millions of genital warts and thousands of cancer-related deaths over the next century, but it can result in financial benefits in quality-adjusted life as well as the preservation of people's life (Montas, 2019).

In 2011, although the HPV vaccine among the United States adolescent population has increased following its licensure, it remains low in comparison to other recommended vaccines for adolescents such as meningococcal conjugate, tetanus, and diphtheria, and acellular pertussis (Ventola, 2017). The need for an alliance between

healthcare professionals and parents to be educated about the important roles they can play, and benefits that adolescent can derive from the HPV vaccine before onset of sexuality is paramount, also, allowing healthcare professionals to better communicate with parents and patient in recommending the vaccine while at the same time decreasing missed opportunities among adolescents (Holman et al., 2014). Due to the lack of adequate education, there is a need for training about HPV and its implication, which can be facilitated through grounded approaches that will enable bridging of informational gaps about HPV virus that will boost the increase of accepting the HPV vaccine (Thanasas et al., 2020).

Kinder (2016) explored the reasons why parents may defer administration of the HPV vaccine for their children. Kinder (2016) noted, “the majority of parents (75%) deferred administration of the HPV vaccine because they believed it was too new or required further research” (p. 551). Also, “parents are often intimidated about new vaccines surfacing in the health field (such as the new HPV9 vaccine) and question whether these new vaccines are for monetary benefits of pharmaceutical companies and physicians or provide a benefit for their child’s health” (p. 557).

Nanagas et al. (2016) in a study on adolescent male HPV vaccination noted that during the HPV4 vaccine permissive and universal periods of recommendations the acceptance rates among male adolescents was high, on the contrary, observance was also made of lower rates of acceptance following the national call for universal vaccination of male adolescents. Furthermore, it was found that low-income clinics had higher uptake of the HPV vaccines among the male adolescents’ population in comparison to the suburban

private clinics, which depicted lower national uptake (Nanagas et al., 2016). With improved knowledge of parents and male adolescents in conjunction with the support of HCP, acceptance of the uptake of the HPV4 along with other recommended adolescent vaccination vaccine can be realized thereby, assisting the upsurge of the vaccine in male adolescents (Nanagas et al., 2016).

Parents' Attitude on Vaccines in General

A growing number of parents are avoiding vaccines or opting not to vaccinate their children entirely. This raises the risk of contracting vaccine-preventable diseases and undermining herd immunity, as well as impairing trust in the capacity of healthcare systems to protect individuals. Vaccine resistance is linked to a number of psychological and demographic determinants, such as vaccine behaviors, societal norms, and faith in science (Damnjanović et al., 2018). Parental approval of routine childhood immunization is crucial to protecting the health of children, as high vaccination-coverage levels result in lower levels of vaccine-preventable diseases in the US. While concern about the safety or necessity of vaccination is not a new phenomenon, in recent years several factors, including the number of vaccines in the prescribed childhood immunization schedule, have increased the perception among some parents that vaccines are unsafe for their children (Kennedy, Basket & Sheedy, 2011).

Several factors have increased in recent years, including the number of vaccinations in the prescribed childhood immunization schedule, the prevalence of contradictory evidence on vaccine safety and disinformation online and elsewhere, and medically debunked but widely circulated hypotheses linking vaccinations to chronic

health conditions or developmental disorders such as autism (Kennedy et al., 2011). To sustain and strengthen the effectiveness of childhood vaccinations in disease prevention, there needs to be a comprehensive approach to resolving the concerns of parents on an ongoing basis. Listening to and reacting to specific questions and concerns in ways and with resources will help parents make more informed decisions on vaccination (Kennedy et al., 2011).

Vaccines are one of the 20th century's most effective public health methods to prevent sickness, injury and death. Since vaccinations were so effective, perceived risks from vaccine-preventable diseases decreased, while perceived vaccination risks increased. Parental behavior and vaccination preferences are significant factors in determining an immunization status for an infant. Reports from multiple studies have indicated that mothers believe they don't have enough knowledge about immunization (Vannice et al., 2011). The standard statements on vaccine information (VIS), which providers are mandated by law to give to parents (National Childhood Vaccine Injury Act of 1986), have been criticized for their high level of reading and for lack of detail. Also, when VIS is given, parents may not have enough time to review written materials while also taking care of their child during an immunization visit (Vannice et al., 2011).

More and more parents are refusing to vaccinate their kids. The proportion of pediatricians reporting refusals to provide parental vaccine increased from 74.5% in 2006 to 87.0% in 2013 ($p < .001$). Pediatrists believe that parents are gradually avoiding vaccines because parents think they are unnecessary (63.4% vs. 73.1% in 2006; $p = .002$). A total of 75.0 percent of pediatricians reported that parents postpone vaccines due to

pain concerns, and 72.5 percent suggested that they postpone due to the immune system strain concerns. In 2006, 6.1% of pediatricians reported that they “always” dismissed patients for continued refusal of vaccine, and by 2013 that percentage increased to 11.7% ($p = .004$) (Hough-Telford et al., 2016). Pediatrists registered increased refusals of vaccines between 2006 and 2013. They perceive those parents who refuse vaccines increasingly think immunizations are unnecessary. Pediatrists tend to provide information on vaccines but still reject patients at higher levels (Hough-Telford, 2016). Despite believing in the importance of vaccination by a vast majority of parents, most parents had concerns about the safety of the vaccines. Strategies are needed to address important misperceptions about the safety of vaccines as well as additional research assessing vaccine safety to ensure public confidence (Bardenheier et al., 2004).

In conclusion, despite the foregoing, it is incumbent on HCP to gain knowledge to circumvent the increase in vaccine hesitancy among parents. Parents receive a plethora of vaccine messages. As parents continue to receive a multitude of messages, it becomes increasingly difficult to distinguish which information is important, as several of these messages frequently contradict each other. Sometimes the inconsistency of facts leads to perplexed customer safety. Kestenbaum and Feemster (2015) stressed that it is necessary to remember that all the knowledge provided to parents is not reliable and is a major contributor to misinformation concerning vaccinations.

Acceptance of the HPV Vaccine and Vaccine Uptake

With HPV causing some cervical and anogenital cancers, the Food and Drug Administration (FDA) in 2006 approved the quadrivalent vaccine as a preventative

measure to lower the rate of HPV infections, related diseases, and cancers (Patel, 2013). Later on, in 2009, the FDA indicated the expansion of the quadrivalent vaccine for male adolescents between the age of 9-26 years would help in circumventing issues such as preventing genital warts in male adolescents, preventing HPV-related cancers in men having sex with men, and preventing transmission of HPV to females adolescents' sexual partners (Patel et al., 2013). Although there are many benefits to be derived from the HPV vaccine, there still exists hesitancy among some parents to have their adolescents vaccinated; therefore, there is a need for concerted efforts to be employed in educating providers who may not be experienced in treating patients with HPV-related diseases about the consequences about management (Patel et al., 2013).

Although vaccines are known to contribute to preventative measures in pediatric care and other areas of health prevention, parents continue to wrestle with doubts and questions about their safety and efficacy thereby, contributing to the low vaccination rates in some specific communities. Due to the previous issues, resulting factors include healthcare providers' burnout, compounded with unsatisfied job fulfillment also indirect results of increased morbidity and mortality. Also, with vaccine hesitancy among parents, the chances for public health threats exist (McClure et al., 2017). Further, the need for behavioral change principles in collaboration with communication means are paramount to approaching and addressing vaccine hesitancy with collective efforts at the grassroots (community) levels with the intent of stronger policies for uptake of vaccines that will help in contributing to increase in the low vaccination rates (McClure et al., 2017).

Despite the means at hand to reduce genital warts and HPV-associated diseases (cancers) with the HPV vaccine, globally, HPV uptake remains low. Several factors such as research on HPV vaccine being more focused on women with an association with cervical cancer and ACIP recommending it earlier for girls (2006) than for boys, which happened later in 2011, contributed to the low rates in the uptake of the HPV vaccine. However, there remains the existing burden of several non-cervical cancers, as well as the continuing rise of anal cancer in men (Lacombe-Duncan, 2018). Also, parents' belief of onset of sexuality among their male adolescents, due to (parents') their inability to monitor their male adolescents' activities increase parents' desire to have them (male adolescents) receive the HPV vaccination. In some studies, parents who desire to have their male adolescents receive the HPV vaccine do so for various reasons such as emphasizing protecting them against cancer; and some against genital warts. However, when looking at key relationship among parents and their adolescent male, certain varied interpersonal factors exist that plays a vital role in HPV vaccine acceptability, for example, it all depends on sons' openness among parents and their HCP; therefore, parents rely on the HCP to build a trusting relationship with their sons to enable their (sons) openness with their HCP about their sexual activities (Lacombe-Duncan, 2018).

Parents not only recognize the similarities of the HPV vaccine and other adolescent vaccines but also the protections which can be derived by their adolescent child from certain diseases. However, while some parents view all adolescent vaccines to include HPV vaccine as important for their (adolescent's) overall health, some (parents) who wrestle with the thought that the vaccine is related to sexually transmitted diseases at

times does evoke a mixed reaction. Nonetheless, parents uphold the added benefit of the HPV vaccine positively due to its cancer prevention benefits (Ogunbajo et al., 2016). By understanding the benefit which can be derived from HPV vaccines, parents would become more knowledgeable in making decisions that may help to increase HPV vaccine uptake. In so doing, further initiatives can be derived where the HPV vaccine, in combination with other adolescent vaccines that were known to be successful, can be taken into account when possible (Gordon et al., 2013). Also, with reference to policy initiatives about school entry immunizations requirements such as Tdap and MCV4, if the HPV vaccine were included, that may have caused less opposition among parents who would have viewed it (HPV vaccine) as beneficial as the other vaccinations for disease prevention and its benefit in cancer prevention (Ogunbajo et al., 2016).

Also, Nanagas et al. (2016) in a study on adolescent male HPV vaccination pointed out that during the HPV4 vaccine permissive and universal periods of recommendations the acceptance rates among male adolescents were high, on the contrary, observance was also made of lower rates of acceptance following the national call for universal vaccination of male adolescents. Furthermore, it was found that low-income clinics had higher uptake of the HPV vaccines among the male adolescents' population in comparison to the suburban private clinics, which depicted lower national uptake (Nanagas et al., 2016).

Furthermore, with improved knowledge of parents and male adolescents in conjunction with the support of HCP, acceptance of the uptake of the HPV4 along with other recommended adolescent vaccination vaccine can be realized thereby, assisting the

upsurge of the vaccine in male adolescents (Nanagas et al., 2016). Furthermore, Tan and Gerbie's (2017) aim in their study were to get an understanding of the perception of HPV disease and acceptance/barriers to HPV vaccine by parents of boys 9-18 years. Further, The objectives of this study were the following: (a) to gain an understanding of the perceptions of HPV disease, and acceptance and barriers to HPV vaccination in parents of boys aged 9 to 18 years who obtained their primary medical care from private pediatric offices compared with those who received their care at public health clinics, (b) to determine if these perceptions differed between these two groups of parents, and (c) to identify perceived barriers to vaccination that would need to be overcome to improve HPV vaccine acceptance in this population.

Parents' Sociodemographic Factors and Vaccine Acceptance

In low-, medium- and high-income communities, social determinants may affect routine childhood immunization efforts. In addition, this can influence herd immunity and the implementation of new vaccines, both of which are important in reducing infant morbidity and mortality. Gaining full understanding of the effects of social determinants and tackling them as part of the overall challenge of resolving obstacles to immunization is of vital importance for these reasons (Glatman-Freedman & Nichols, 2012). Childhood vaccination efforts in Canada have been negatively affected by vaccine hesitation among parents based on their vaccination knowledge, attitudes and beliefs (KAB). The extent to which child vaccination is received and KAB varies according to the socioeconomic status of parents is less understood (Carpiano et al., 2019).

A number of potential factors is defined as being correlated with low immunization rates, including multiple socio-economic factors such as low family income lack of health insurance low levels of parental education, nonwhite ethnicity, young age of parents, involvement of other siblings in the household, and socioeconomic barriers such as lack of regular healthcare or decreased availability of medical services. Different research indicates that vaccine-associated factors, including the actions of doctors, have a substantial effect on vaccination coverage (Danis et al., 2009). Although, research was carried out in geographically restricted areas with distinct cultural influences and disparities in healthcare systems, restricting the generalizability of results, key factors remain the same which are linked to under-immunization due to socio-economic conditions (Danis et al., 2009).

In some studies, discoveries were made which found that perceived barriers to parental health beliefs and attitudes about childhood vaccination as a risk for under-vaccine factors. On the other hand, in other studies, there is conclusion that parental attitudes and convictions could not be explained for under immunization, with a few that say socioeconomic factors more importantly, play a role. Further, a new study has shown that socio-demographic characteristics may affect beliefs, attitudes and perceived control that ultimately determine vaccination (Danis et al., 2009). Delaying childhood vaccines extend the child's vulnerability to Vaccine Preventable Diseases (VPD) and are a predictor of incomplete vaccination status at a later age (Périnet et al., 2018). Furthermore, previous research has shown that, in jurisdictions within or comparable to Canada, timely vaccination is associated with family and/or health-related socio-

demographic characteristics and KAB with respect to vaccination. Associations between parental KAB and vaccination delays may indicate vaccine hesitation, which refers to "delay in vaccination acceptance or refusal despite the availability of vaccination services" as defined in one of its definitions (Périnet et al., 2018).

Parents' Sociodemographic Factors and HPV Vaccine Uptake

Ethnicity

In the United States although the HPV vaccination is effective in providing preventative measure for cancers, as it relates to the burden of HPV-associated cancers there is dissent among racial and ethnic groups (Burger et al., 2016). On the other hand, there are different level of knowledge about the possible risk factors among those ethnic groups (Cuschieri et al., 2006). Through the adoption of the HPV vaccine, there can be a reduction in one's increased lifetime risk in contracting HPV and reduce HPV-associated cancer among all racial/ethnic groups as well as the reduction in the degree of disparities. Similarly, with the second generation of the HPV vaccine, there remains disparities in the areas of access to preventive health services and cancer therapies among race and ethnicities which will continue to widen if not addressed (Burger et al., 2016). To avoid the exacerbating contrariety in the incidence of cervical cancers and mortality in the future, increasing HPV vaccination in all adolescents (female and male) to include all racial, ethnic, and income groups is of importance (Jeudin et al., 2014).

Furthermore, research has shown that specific strategies may be unsuccessful in helping in HPV vaccination achievement across all races and subpopulations. However, low-income and minority parents are interested in vaccinating their children just the same

as white, affluent parents (Jeudin et al., 2014). However, although there have been high rates of HPV vaccine initiation among low-income and minority adolescents, in comparison to their more affluent white counterparts, there exists lower completion rates. Those lower rates, are in consort with vaccination completion within racial/ethnic and income groups, which are contributing factors to HPV vaccine incompletion and not being knowledgeable of subsequent doses compounded with side effects, other life's issues, and time; also, location/availability of health centers (Jeudin et al., 2014).

Education

The importance of addressing HPV prevention through immunization remains a critical and vital issue in the education of patients and their parents, as well as profound HCP's recommendation. Furthermore, some studies have shown positive correlations between immunization and physician recommendation of the HPV4 vaccine in female adolescents among parents in the uptake of the HPV vaccination among male adolescents, compared to parents of unvaccinated teens (Nanagas et al., 2016).

Also, in another study, it has been substantiated that one of the leading causes for non-vaccination expressed by parents is the lack of recommendation by their adolescent male children's HCP (Nanagas et al., 2016). A misconception exists among male adolescents of all ages due to a knowledge gap about the awareness of HPV infection and other factors such as morbidity, transmission, and prevention thereby, causing a misnomer that the vaccine is meant only for sexually active individuals. Due to a lack of knowledge, some parents try to justify that the vaccine is not needed for their adolescent

children; therefore, it is of importance to emphasize the benefits of HPV vaccine by educating the parents (Nanagas et al., 2016).

The need for early intervention to increase awareness with an emphasis on favorable outcomes about HPV and HPV vaccination among adolescents should be continuous to reap long-term benefits. For example, the concepts identified in the HBM illustrates that partial or minor changes that can affect an individual's health beliefs and their actual health behavior. Therefore, where low perceived risk and minimal knowledge exist, there will be a need to provide education about HPV at an early stage in consort with reinforcement on a repetitious basis with a public health perspective (Grandahl et al., 2018). Furthermore, in schools where sexual education is mandatory, HPV should be included in curriculum on a regular basis as is mandated by the World Health Organization (WHO) about sexuality education (Grandahl et al., 2018).

Summary

This chapter was a review of the factors relevant to the relationship between parents' intention and uptake of HPV vaccine for male adolescents. There are still prominent gaps in the purpose and acceptance of the HPV vaccine by parents in their male adolescents. Male adolescents and parents do not entirely grasp HPV vaccination and the advantages that can be gained for their sons and potential partners. Future initiatives must target parents and male adolescents to raise knowledge and understanding of cancers associated with HPV, and HPV vaccine. In the following chapter, this researcher will present explanations of the methodology, setting, instrument, analysis, and ethical guidelines.

Chapter 3: Research Method

Introduction

The literature review confirmed that other research relating to male adolescents' uptake of the HPV vaccine did not focus on the role of the parent in the uptake of the HPV vaccine among this population. Therefore, in this study, I focused on the relationship between parents' decision making and uptake of the HPV vaccine among male adolescents in the United States. In this chapter, I describe the secondary data source, instrumentation, and the operationalization of constructs. Details about data analysis, validity, and ethical procedures will also be covered.

Research Design and Rationale

In this study, I employed a quantitative approach to obtain a sense of what factors or variables influence an outcome. Quantitative research can be defined as

> emphasizing the collection of numerical data and exhibiting the view of the relationship between theory and study as deductive, a predilection for an approach to natural science, and an objectivistic view of social reality. (Bryman et al., 2015)

Secondary data were used to explore the relationship between the decision making of parents and the uptake of the HPV vaccine among male adolescents. Data were obtained from the NIS-Teen 2016 data set (CDC, 2018). The independent variables were parental intention to uptake other vaccines, such as Tdap and parents' sociodemographics, such as level of education. The dependent variable was the decision making of parents on uptake of the HPV vaccine within the next 12 months. The analytical method consisted of

multiple logistic regression to assess the relationship between the independent variables and the dependent variables.

Secondary analysis is an efficient and cost-effective method of generalizing results for greater external validity from a broad sample to a population, evaluating results using statistical methods, and defining subgroups with the appropriate sample size for additional research (Creswell, 2009; Dale, 2004). Therefore, the use of validated, accurate instruments increases trust in internal validity and minimizes bias in data collection as much as possible (Creswell, 2009). A quantitative analysis of national data can advance understanding of the factors that impact the uptake of the HPV vaccine among male adolescents. In this section, I outline how the research was conducted by defining the study population, sampling techniques, secondary data set access, instrumentation, the operationalization of models, validity, risks and ethical considerations applicable to the study.

Methodology

Secondary Data Source

The NIS are a collection of telephone surveys used for tracking vaccination coverage among children ages 19–35 months and teens ages 13–17, and for children ages 6 months to 17 years for flu vaccinations. The surveys were funded and administered by the CDC National Center for Immunization, and Respiratory Diseases and are approved by the Public Health Service Act Sections 306. In April 1994, data collection for the first survey started to test the coverage of the vaccine following measles outbreaks in the early 1990s (CDC, 2018). The NIS-Teen was introduced in 2006 to control routine

immunization vaccine coverage among adolescents and teenagers and to provide a reliable data set for monitoring routine vaccine needs and outcomes in a single year and over time (CDC, 2017; Jain et al., 2009). Past surveys, such as the National Health Survey, have relied on personal immunization cards or parental remembrance, but few households kept vaccination cards, and parental remembrance was less reliable than cards (Jain et al., 2009). Certain surveys were based on local data or records. For NIS-Teen, analysts used weights to estimate the coverage of vaccines in the country and by state and selected local area; researchers may also stratify by interest variables (CDC, 2017).

Researchers collected data from parents and adolescent vaccine providers to boost the quality and reliability of NIS-Teen self-reported data (CDC, 2017). Parent-reported history of vaccines varied by vaccine, especially for recently prescribed vaccines, and the use of provider parent confirmation reports improved the validity of the NIS-Teen. Owing to discrepancies among estimates collected from households with and without adequate provider data in the early years of the study, analysts still use adequate provider data when presenting vaccine coverage estimates (Jain et al., 2009).

Recruitment, Participation, and Data Collection

The NIS uses a standard survey methodology to provide national, population-based, state, and local area estimates of vaccination coverage among children (19 to 35 months) and teens (13 to 17 years). The surveys collect data in all 50 states, the District of Columbia, and several U.S. territories through telephone interviews with parents or guardians. Cell phone numbers are picked randomly, and calls are made to the household to enroll one or more qualifying children or teenagers (CDC, 2018). Also, during the

interview, parents and guardians of eligible children are asked for the names of vaccine providers for their children and permission to contact them. Data are used to track the coverage of vaccination among teenagers at national, state, and selected local areas and some in U.S. territories. The NIS-Teen covers the following regular adolescent vaccines: tetanus, diphtheria, and acellular pertussis (Tdap), meningococcal conjugate (MenACWY), HPV, and flu.

During the interview, parents and guardians of eligible children are asked for the names of vaccine providers for their children and permission to contact them (CDC, 2018). Upon receipt of parental authorization, a questionnaire is sent to the vaccine providers of each child to obtain details on vaccine forms, number of doses, dates of operation, and other administrative details regarding the healthcare facility. Vaccination coverage rates are calculated for the child and adolescent vaccines recommended by the ACIP, and children and adolescents are graded as up to date based on the number of doses recommended by the ACIP for each vaccine (CDC, 2018). This NIS-Teen mail survey section was responsible for provider record search. On both landline telephone and cellphone sample cases, the provider record search is conducted in the same manner (CDC, 2017). Furthermore, the directions ask vaccination providers to post the vaccination history questionnaire or fax it back after completion. Two weeks after the initial mailing, providers who have not yet answered are given a telephone call informing them and encouraging them to complete the form and either post or fax back the details. For certain cases, vaccination records recorded by providers are completed over the phone. The questionnaire data are compiled, entered, cleaned, and combined with the

research data design survey household details to create a record at the teen stage (CDC, 2017).

Sample Size and Power

For sample size and power, G*power 3.1 was used (Faul et al., 2013) to calculate the power needed to detect the likelihood of a statistically significant relationship between parents' decision making and the uptake of the HPV vaccine among male adolescents, should such significance exist. The minimum sample size of 950 was needed to obtain 95% power in the study. The NIS Teen has over 43,000 participants so a subsample for analysis of at least n = 1,000 was used. In this analysis, a compromise power analysis was used; due to the sample size, beta/alpha (β/α) ratio, and impact size, this study allowed the estimation of the power and implied alpha. All statistical analyses were based on weighted data. However, a subset (n = 1,592) of the data was used for sample size for the purpose of this power analysis. For this power analysis, a probability ratio (OR) of 1.68 was used, as has been estimated (OR) from previous research (Hofman et al., 2013; Okuhara et al., 2018; Pot et al., 2017), the odds ratio was calculated using a small effect size of 0.20, equivalent to an OR = 1.68 (Chen et al., 2010).

Errors of Type I (referred to as α) and of Type II (referred to as β) are generally considered significant (Faul et al., 2009; StatPower, n.d.). Errors in Type I occur when a null hypothesis is rejected when valid, and errors in Type II occur when a null hypothesis is not accepted when the alternative hypothesis is true (McCrum-Gardner, 2010). Because both types of errors are equally bad for this study, the β / α ratio was set at 1 rather than any other value, such as 2, which means a researcher is two times more likely

to commit a Type II error than a Type I error. The calculated power was 0.981 based on the conditions for a compromise power analysis (N = 1.592, β / α ratio = 1, OR = 1.68, a two-tailed binomial test). This power estimate was adequate to identify a significant relationship between parents' intention and the uptake of the HPV vaccine among male adolescents, if there was such significance.

Access to Secondary Data

The NIS-Teen data set is available in the public domain through the CDC website (CDC, 2015). No permission is required to use the data set for statistical analysis.

Operationalization of Constructs

The following constructs will be used from the NIS-Teen survey:

Parental decision making regarding uptake of other vaccines, such as Tdap, is a nominal variable. The following interview questions were used: (a) Did the teen receive a tetanus shot? (b) Did the teen receive a diphtheria shot? and (c) Did the teen receive the Tdap shot? Each of those questions were coded with yes as 1, and no as 0.

HPV vaccine uptake is a binary variable of the key dependent variables, HPV vaccination completion reflects whether the respondent indicates that their adolescent child received three or more doses of the HPV vaccine series. Although the NIS-Teen survey collects data on up to eight reported HPV shots received for variable HPVI_ANY Type: Numeric Position: 109-110 Source: TIS_BHPV2 in 2016; the series is made up of three shots, with recent recommendations to administer two shots for eligible adolescents. In the analysis the code will be; Has [TEEN] ever received HPV shot? yes = 1, no = 0, don't know = 77, and refused =99.

Education is an ordinal variable coded as What is the highest grade or year of school [FILL] completed? 8th grade or less coded 1, 9th–12th grade no diploma coded 2, high school graduate or GED completed coded 3, completed a vocational, trade or business school program coded 4, some college credit but no degree coded 5, associate degree (AA, AS) coded 6, bachelor's degree (BA, BS, AB) coded 7, master's degree (MA, MS, MSW, MBA) coded 8, doctorate (PhD, EdD) or professional degree (MD, DDS, DVM, JD) coded 9.

Demographics include nominal and ordinal variables. Ethnicity is a nominal variable. Data were collected by asking the question: Was [TEEN]'s mother of Hispanic or Latino origin? Yes = 1, No = 0, Don't know = 77, and Refused = 99. By separating participants into the following six groups, race was measured: White = 1, Black/African American = 2, American Indian = 4, Asian = 5, Native Hawaiian = 6, and Pacific Islander = 7.

Data Analysis Plan

Secondary NIS-Teen data for 2016 was analyzed using R-4.0.5 for Windows, which included univariate, bivariate, and multivariate analyses. After downloading the data, the data set was checked for incorrect values, duplicated data, or missing data. To simplify the set of data, all variables not relevant to the study were deleted. Missing data was coded as such to ensure what is appropriately handled during the analysis. The originator of the NIS-Teen data collection imputed values to compensate for the missing data in case of nonresponses (CDC, 2016). Nevertheless, missing data was omitted from all statistical analyses where appropriate.

Recoded variables of interest in the current study were used to analyze the research questions. In cases where the variables were nominally scaled, the data may be unlikely to have outliers; however, the data were assessed for outliers for numerical variables where applicable. Based on the survey question being answered, outliers were removed as deemed appropriate. All statistical analyses were weighted data based. The statistical significance was based on the standard alpha value ($\alpha = 0.05$) for all statistical tests. The p-value was determined whether a null hypothesis is accepted or rejected. The null hypothesis is dismissed in favor of the alternative hypothesis if the p-value was less than or equal to 0.05. The questions and hypotheses to the study are as follows:

This study examined two research questions:

RQ1: Is there a relationship between parental demographics, such as race, ethnicity, and education level, and the uptake of HPV vaccines for their adolescent male child?

H01: There is no statistically significant relationship between parental demographics and the uptake of HPV vaccines for male adolescents.

Ha1: There is a statistically significant relationship between parental demographics and the uptake of HPV vaccines for male adolescents.

The data was analyzed in three stages. For the first step, univariate analysis produced descriptive statistics. For the second stage, a bivariate analysis was performed to evaluate the association between other vaccine uptakes. This association was evaluated using chi-square tests because all variables are categorical.

To fit the multiple logistic regression model, the stepwise regression was used. Variables were added to the model using forward selection, starting with an empty model (i.e., a model with only the constant) and adding all other variables of interest (i.e., independent variables and covariates) sequentially. The model's significance was assessed by the cumulative effect of the independent variables, as expressed by χ 2 coefficient. The Nagelkerke R 2 measures the variation on the dependent variable, which the independent variable accounts for. The Wald coefficient was used to evaluate the importance of IV.

The probability that the uptake of other vaccines affected the uptake of HPV vaccine in male adolescents was determined by the odds ratio (OR) and interpreted as follows: An odds ratio value greater than 1.0 indicates an increased chance of uptake of the HPV vaccine, and an odds ratio value less than 1.0 indicates a decreased chance of uptake of the HPV vaccine among male adolescents.

RQ2: Is there a relationship between parental decision-making regarding vaccines as measured by uptake of other vaccines (Tdap) and uptake of HPV vaccines for their adolescent male child, after controlling for race, ethnicity, and education level?

H02: There is no statistically significant relationship between parental decision making regarding vaccines as measured by uptake of other vaccines (Tdap) and uptake of HPV vaccines for their adolescent male child, after controlling for race, ethnicity, and education level.

Ha2: There is a statistically significant relationship between parental decision making regarding vaccines as measured by uptake of other vaccines (Tdap) and uptake of

HPV vaccines for their adolescent male child, after controlling for race, ethnicity, and education level.

In the third stage of analysis, multiple logistic regression modeling was carried out to assess the association between the uptake of other vaccines and HPV vaccine uptake among male adolescents, adjusting for maternal education, parents' demographics, such as race and educational level.

Logistic regression was used to assess the extent to which the relationship between parents' demographics, such as race and educational level, affected the uptake of the HPV vaccine among their adolescent male children. A logistic regression model predicts a dependent data variable by analyzing the relationship between one or more existing independent variables. To fit the regression model, the stepwise regression was used. Variables were added to the model using forward selection, starting with an empty model (i.e., a model with only the constant) and adding all other interest variables (i.e., independent variables and covariates) sequentially. The model's significance was assessed by the cumulative effect of the IV, as expressed by χ 2 coefficient. The Nagelkerke R 2 measures the variation on the dependent variable, which the independent variable accounts for. The Wald coefficient will be used to evaluate the importance of IV.

The probability that the uptake of other vaccines affected the uptake of the HPV vaccine among male adolescents was determined by the adjusted odds ratio (OR) and interpreted as follows: An odds ratio value greater than 1.0 indicates an increased chance of the uptake of the HPV vaccine, and an odds ratio value less than 1.0 indicates a decreased chance of the uptake of the HPV vaccine among male adolescent.

Threats to Validity

External Validity

There is one remaining problem between researchers and a possible data treasure known as external validity (Bisbee & Larson, 2017). External validity addresses variables in a report that may decrease the production generalizability. It is an act of reasoning involving the drawing of broad inferences from specific findings, which is generally accepted as a quality norm in quantitative research (Polit & Beck, 2010). In relation to the study, the findings can be generalized and limited to the study design. For example, the NIS-Teen is a cross-sectional survey; hence, the information obtained from the respondents represents the snapshot of time. Therefore, research of this nature may not produce the same results a year, five years, or even 10 years into the future.

Furthermore, the target population in this study is male adolescents, so the results may not be evident for post male adolescents. Another threat to the external validity of this study is the Hawthorne Effect, in which the participants being studied, appear to adjust their attitudes because they know they are being observed. In so doing, participants responses could be different than they would have in another settings.

Internal Validity

Internal validity is the degree to which a test creates a trustworthy relationship of cause and effect between a treatment and a result. Internal validity often represents the probability of excluding alternate explanations for the findings in a given study. It is characterized as the degree to which the findings observed reflect the reality in the studied population and are, therefore, not due to methodological errors (Patino &

Ferreira, 2018). Inferences based on the results of this analysis may have been challenged by the method used to calculate interest variables, and by the impact of the interviewers. The NIS-Teen and other surveys were performed by the University of Chicago's National Opinion Research Center under the CDC (CDC, 2016). The instrument was a pretested, structured questionnaire conducted by highly qualified screeners and interviewers, thus reducing threats of this type (CDC, 2016).

Other threats to the internal validity of a study can be due to subject effects. Because the NIS-Teen is a cross-sectional study, it may have been susceptible to recall bias because the respondents were asked questions regarding the adolescents' vaccination status in the households. The responding parents may have given incorrect details about the vaccination status of their children. HCPs have been asked to verify the children's vaccination status with the parents' consent. Furthermore, the vaccination status reported by some parents could have been different from those provided by the HCPs. Although provider-verified vaccination information was critical to estimating vaccine coverage, there may have been unresolved discrepancies in reporting, as there was no second contact with healthcare providers or parents to resolve such issues.

Construct Validity

One of the most central concepts in psychology is building validity. In general, researchers determine the validity of a measure by correlating it with a variety of other measures and arguing from the pattern of correlations related to these variables in potentially predictable ways (Westin & Rosenthal, 2003). Constructing validity is one of the most significant concepts in all of psychology. At the heart of every analysis,

researchers use measurement as an index of a variable not immediately measurable by itself (for example, intelligence, aggression, or operating memory). When a study (or, more generally, the psychological method, including experimental manipulation) lacks the validity of the model, the results achieved will be difficult to interpret using that test or procedure (Westin & Rosenthal, 2003). The NIS-Teen data were extensively used, and, as such, researchers accepted the robustness of the sample and minimized this hazard (CDC, 2016).

Ethical Procedures

The CDC and all other NIS-Teen workers are bound by confidentiality agreements to safeguard the privacy and confidentiality of protected health records, including data disclosure (CDC, 2015; CDC, 2016). The collected data can only be used for analysis, and the National Center for Health Statistics (NCHS) Disclosure Review Board reviews the public-use data file before release to ensure privacy and confidentiality are protected (CDC, 2015; CDC, 2016). Moreover, certain variables that might classify participants are not included in the data file for public use or have the categories collapsed and listed in aggregate.

Multiple data sets when merged offer rise to composite photographs of individuals and expose their identities. The data set downloaded for this study had not been shared with or combined with other researchers and other data sets to avoid the risk of encroaching on the respondents' privacy (Metcalf and Crawford, 2016). Security of data was assured concerning the security of written and electronic data from physical harm and the security of data integrity, including harm from misuse or theft. It refers to

the amount of time that the project data must be kept in compliance with the guidelines provided by the sponsor or funder. It also includes data destruction, which is secure (Office of Research Integrity, n.d.). Before conducting any part of this research, formal approval was obtained from the Institutional Review Board (IRB) of Walden University to conduct this study.

Summary

A quantitative secondary data study analysis of the NIS-Teen 2016 database set was performed to check the relationship between uptakes of other vaccines (Tdap), and parents' decision making on uptake of the HPV vaccine among their adolescent male children, the relationship between parent's' socio-demographics, such as education level, and the uptake of the HPV vaccines among their adolescent male children. Specifically, a quantitative study to assess the relationship between uptakes of other vaccines (DTap), and parents' decision making on uptake of the HPV vaccine among their adolescent male children, and the relationship between parent's' socio-demographics, such as education level, and the uptake of the HPV vaccines among their adolescent male children. Secondary data from 2016 NIS-Teen was used to conduct the study. The nature of the research and the reasons for its selection was addressed in this chapter. The target population was explained. The power associated with the sample size available for this study was calculated using G*Power 3.1 via a priori power analysis. The manner in which interest structures were operationalized were also discussed. Logistic regression was used to determine the significance of the relationship between uptakes of other vaccines Tdap, and parents' decision making on uptake of the HPV vaccines among their

adolescent male, and the relationship between parent's' socio-demographics, such as education level, HCP recommendation and the uptake of the HPV vaccines among their adolescent male.

Chapter 4: Results

Introduction

The purpose of this study was to assess the role of parents in the uptake of the HPV vaccine among their adolescent male children ages 13–17 in the United States. Specifically, I focused on investigating the association between HPV vaccine hesitancy factors, including parents' demographics and parental decision making, and the uptake of HPV vaccine by their adolescent male children. Two research questions were answered in this study:

RQ1: Is there a relationship between parental demographics, such as race, ethnicity, and education level, and the uptake of HPV vaccines for their adolescent male child?

H01: There is no statistically significant relationship between parental demographics and the uptake of HPV vaccines for male adolescents.

Ha1: There is a statistically significant relationship between parental demographics and the uptake of HPV vaccines for male adolescents.

RQ2: Is there a relationship between parental decision making regarding vaccines as measured by uptake of other vaccines (Tdap) and uptake of HPV vaccines for their adolescent male child, after controlling for race, ethnicity, and education level?

H02: There is no statistically significant relationship between parental decision making regarding vaccines as measured by uptake of other vaccines (Tdap) and uptake of HPV vaccines for their adolescent male child, after controlling for race, ethnicity, and education level.

Ha2: There is a statistically significant relationship between parental decision making regarding vaccines as measured by uptake of other vaccines (Tdap) and uptake of HPV vaccines for their adolescent male child, after controlling for race, ethnicity, and education level.

In this chapter, I present the results of secondary data analysis. I analyzed the 2016 NIS-Teen secondary data using R-4.0.5 for Windows. After conducting simple descriptive analyses of the 2016 NIS-Teen public-use data file, I subset the data to include weight, household-reported vaccination information, and demographic variables related to the research questions. I performed descriptive summaries for those variables and conducted the bivariate analysis to examine the correlations, followed by multiple logistic regression to determine for statistically significant associations between the predictor variables and the male teen ever receiving any HPV shots. I conclude this section with a summary of the findings from the data analysis.

Data Collection

In 2016, the NIS-Teen survey's target population was adolescents 13–17 years living in the United States in all 50 states, the District of Columbia, and U.S. territories (the U.S. Virgin Islands, Guam, and Puerto Rico) at the interview time (CDC, 2017). The household interviews began on January 14, 2016, and ended on February 8, 2017. A total of 44,771 teens (9,502 landlines and 35,269 cellphones) accepted the interview. Of which, 21,843 (5,126 landlines and 16,717 cellphones) had adequate provider data (provider-reported vaccination data adequate to determine whether the teen was up to date for the recommended vaccination schedule). The response rates were 55.5% and

29.5% from those contacted via landline and cell phone, respectively. However, the U.S. Virgin Islands and Guam were not included in the 2016 public-use data file to protect confidentiality. Therefore, the 2016 NIS-Teen public-use data file (which does not include data for the U.S. Virgin Islands and Guam) contains 43,071 teens with completed household interviews; 20,880 teens (48.5%) have more extensive data (e.g., provider-reported vaccination histories and facility data with adequate provider data, including 156 unvaccinated teens).

Descriptive Statistics

The baseline descriptive and demographic characteristics of the 43,071 teens who have completed household interviews and 20,880 teens with adequate provider data are listed in Table 1.

Table 1

Descriptive Statistics of NIS-TEEN 2016 Participants

	Completed household interviews (N = 43,071)	Teen has adequate provider data (N = 20,880)
Age in years of selected teen		
13	8,425 (19.6%)	4,281 (20.5%)
14	8,680 (20.2%)	4,343 (20.8%)
15	8,702 (20.2%)	4,184 (20.0%)
16	8,941 (20.8%)	4,278 (20.5%)
17	8,323 (19.3%)	3,794 (18.2%)
Sex of teen		
Male	22,570 (52.4%)	11,022 (52.8%)
Female	20,501 (47.6%)	9,858 (47.2%)
Census region based on true state of residence		
Northeast	8,156 (18.9%)	4,049 (19.4%)
Midwest	8,695 (20.2%)	4,313 (20.7%)
South	16,125 (37.4%)	7,620 (36.5%)
West	9,018 (20.9%)	4,493 (21.5%)
Missing	1,077 (2.5%)	405 (1.9%)
Race/ethnicity of teen		
Hispanic	7,848 (18.2%)	3,628 (17.4%)
Non-Hispanic White Only	25,915 (60.2%)	12,883 (61.7%)
Non-Hispanic Black Only	4,479 (10.4%)	1,990 (9.5%)
Non-Hispanic other + multiple race	4,829 (11.2%)	2,379 (11.4%)
Poverty status		
Above poverty > $75K	19,204 (44.6%)	9,650 (46.2%)
Above poverty <= $75K	14,117 (32.8%)	6,785 (32.5%)
Below poverty	6,796 (15.8%)	3,692 (17.7%)
Unknown	2,954 (6.9%)	753 (3.6%)
Marital status of mother		
Married	30,263 (70.3%)	14,634 (70.1%)
Never married/widowed/divorced/separated/ deceased/living with partner	12,808 (29.7%)	6,246 (29.9%)

To study the relationship between parents' decision making and uptake of HPV vaccination among male adolescents, the research data set (N = 11,022) was subsetted from the 2016 NIS-Teen public-use data file (Table 2). The research data included all teenage male adolescents who have provider-reported vaccination data adequate to determine whether the teen was up to date for the recommended vaccination schedule. All selected observations have no missing final provider-phase weight information.

Table 2

Unweighted Cross Frequencies: Adequate Provider Data flag and Sex of Teen

	Male	Female
	(N = 22570)	(N = 20501)
Teen with adequate provider data		
Teen has adequate provider data	11,022 (48.8%)	9,858 (48.1%)
Teen does not have adequate provider data	11,548 (51.2%)	10,643 (51.9%)

The age, grade and race/ethnicity distributions of observations are presented in Table 3.

Table 3

Unweighted Adolescent Male Demographic Characteristics, N = 11,022

Characteristic	Total (%)
Age in years of selected teen	
13	2,244 (20.4%)
14	2,309 (20.9%)
15	2,189 (19.9%)
16	2,265 (20.5%)
17	2,015 (18.3%)
Teen's current grade in school	
6th to 8th grade	3,209 (29.1%)
9th to 12th grade	7,654 (69.4%)
HS graduate/GED completed/enrolled in GED program	87 (0.8%)
Not in school/other	62 (0.6%)
Don't know	9 (0.1%)
Refused	1 (0.0%)
Race/ethnicity of teen	
Hispanic	1,887 (17.1%)
Non-Hispanic White only	6,852 (62.2%)
Non-Hispanic Black only	1,050 (9.5%)
Non-Hispanic other + multiple race	1,233 (11.2%)

Results

Research Question 1

RQ1: Is there a relationship between parental demographics, such as race, ethnicity, and education level, and the uptake of HPV vaccines for their adolescent male child?

H01: There is no statistically significant relationship between parental demographics and the uptake of HPV vaccines for male adolescents.

Ha1: There is a statistically significant relationship between parental demographics and the uptake of HPV vaccines for male adolescents.

Univariate Analysis

To answer this question, I built a logistic regression model to evaluate the teens' odds ratio (OR) for ever receiving any HPV shots. The weighted frequencies of output are shown in Table 4.

Table 4

Weighted Frequencies (Including Territories) of HPV Shots Uptake

	Frequency	Percent
Yes	5028593	46.8%
No	4492825	41.8%
Don't know	1226399	11.4%
Refused	1891	0.0%

I had planned to use parental race/ethnicity as an independent variable in the model. In NIS-Teen questionnaire 2016, there was a question asking about Hispanic or Latino origin of the mother (TIS_C8), but this variable does not exist in the 2016 NIS-Teen public-use data file. Therefore, I could not use the parental race/ethnicity variable as a predictor as planned. Instead, I used categorical variables such as mother's age, education level, marital status, and poverty status of family based on exact income. The weighted frequencies are listed in Table 5.

Table 5

Weighted Frequencies (Including Territories): Parental Demographic Variables

	Frequency	Percent
Mother's age		
< = 34 Years	1000187	9.30%
35 to 44 Years	4721441	43.90%
> = 45 Years	5028080	46.80%
Education level of mother (four categories)		
Less than 12 years	1469964	13.70%
12 years	2401466	22.30%
More than 12 years, non-college grad	2609037	24.30%
College graduate	4269241	39.70%
Marital status of mother		
Married	6589165	61.30%
Never married/widowed/divorced/ separated/deceased / living with partner	4160543	38.70%
Poverty status		
Above poverty > $75k	4156306	38.70%
Above poverty <= $75k	3616491	33.60%
Below poverty	2330345	21.70%
Unknown	646566	6.00%

Bivariate Analysis

Before building the logistic regression model to answer the research questions, I initiated bivariate analysis to test the associations between the output and independent variables. For complex survey samples, the standard Pearson chi-squared test is inappropriate due to assumptions that cases are independent of each other are violated. Rao-Scott corrections and their impact, Scott (1981) provided an elegant approach to adjust the common Pearson chi-squared statistic for the complex survey design. However, this method will fail if the contingency table has cells equal to zero because the design effect in this method is a function of the inverse of the weighted cell counts. Each

cross-frequency table between the output and independent variables in my research (Table 6–Table 9) has at least one zero (weighted) cell occurs for rare events. Hence, I cannot use Rao-Scott adjustment Pearson chi-squared statistic to test the independence.

Instead, I applied the Wald and score test statistics for independence based on weighted least squares estimating equations (Thomas, 1990). In the Wald and score test, I got an F test instead of a $\chi 2$ statistic. For RQ1, the F statistic for weighted cross frequencies (including territories): education level of mother with four categories and "has teen ever received any human papillomavirus shots?" has teen F (9,11022) = 5.029 ($p < 0.001$). See Table 6.

The weighted cross frequencies (including territories): marital status of mother and "has teen ever received any human papillomavirus shots?" has F (3,11022) = 3.688 ($p = 0.011$). See Table 7. The weighted cross frequencies (including territories): mother's age categories and "has teen ever received any human papillomavirus shots?" has F (6,11022) = 1.306 ($p = 0.250$). See Table 8. The weighted cross frequencies (including territories): poverty status and "has teen ever received any human papillomavirus shots?" has F (9,11022) = = 2.964 ($p = 0.002$). See Table 9.

Through the bivariate analysis, I found that the mother's education level, marital status, and family poverty status are associated with HPV vaccine uptake. I will use those variables to build the logistic model in the next step.

Table 6

Weighted Cross Frequencies (Including Territories): Education Level of Mother With Four Categories and HPV Shots Uptake

Education level of mother with 4 categories	Has teen ever received any human papillomavirus shots?				Total
	Yes	No	Don't know	Refused	
Less than 12 years	682945	532318	254701	0	1469964
	(46.5 %)	(36.2 %)	(17.3 %)	(0 %)	(100 %)
12 years	1039965	977935	383567	0	2401467
	(43.3 %)	(40.7 %)	(16 %)	(0 %)	(100 %)
More than 12 years, non-college grad	1270785	1118665	219149	438	2609037
	(48.7 %)	(42.9 %)	(8.4 %)	(0 %)	(100 %)
College graduate	2034898	1863907	368982	1454	4269241
	(47.7 %)	(43.7 %)	(8.6 %)	(0 %)	(100 %)
Total	5028593	4492825	1226399	1892	10749709
	(46.8 %)	(41.8 %)	(11.4 %)	(0 %)	(100 %)
$F = 5.029 \cdot p < 0.001$					

Table 7

Weighted Cross Frequencies (Including Territories): Marital Status of Mother and HPV Shots Uptake

Marital status of mother	Has teen ever received any human papillomavirus shots?				Total
	Yes	No	Don't know	Refused	
Married	2970797	2907987	709645	736	6589165
	(45.1 %)	(44.1 %)	(10.8 %)	(0 %)	(100 %)
Never Married/widowed/divorced/separated/deceased/living with partner	2057796	1584838	516753	1155	4160542
	(49.5 %)	(38.1 %)	(12.4 %)	(0 %)	(100 %)
Total	5028593	4492825	1226398	1891	10749707
	(46.8 %)	(41.8 %)	(11.4 %)	(0 %)	(100 %)
F=3.688 p = 0.011					

Table 8

Weighted Cross Frequencies (Including Territories): Mother's Age Categories and HPV Shots Uptake

Mother's age categories	Has teen ever received any human papillomavirus shots?				Total
	Yes	No	Don't know	Refused	
<= 34 years	474361	408860	116966	0	1000187
	(47.4 %)	(40.9 %)	(11.7 %)	(0 %)	(100 %)
35 to 44 years	2118942	2015604	585739	1155	4721440
	(44.9 %)	(42.7 %)	(12.4 %)	(0 %)	(100 %)
>= 45 years	2435290	2068360	523693	736	5028079
	(48.4 %)	(41.1 %)	(10.4 %)	(0 %)	(100 %)
Total	5028593	4492824	1226398	1891	10749706
	(46.8 %)	(41.8 %)	(11.4 %)	(0 %)	(100 %)

F=1.306 · p=0.250

Table 9

Weighted Cross Frequencies (Including Territories): Poverty Status and HPV Shots Uptake

Poverty status	Has teen ever received any human papillomavirus shots?				Total
	Yes	No	Don't know	Refused	
Above poverty > $75k	1906189	1878305	370359	1454	4156307
	(45.9 %)	(45.2 %)	(8.9 %)	(0 %)	(100 %)
Above poverty <= $75k	1739308	1486395	390350	438	3616491
	(48.1 %)	(41.1 %)	(10.8 %)	(0 %)	(100 %)
Below poverty	1068669	883160	378516	0	2330345
	(45.9 %)	(37.9 %)	(16.2 %)	(0 %)	(100 %)
Unknown	314427	244965	87174	0	646566
	(48.6 %)	(37.9 %)	(13.5 %)	(0 %)	(100 %)
Total	5028593	4492825	1226399	1892	10749709
	(46.8 %)	(41.8 %)	(11.4 %)	(0 %)	(100 %)

F=2.964 · p=0.002

Multivariate Analysis

To build the logistic regression model to evaluate the likelihood of male adolescents receiving HPV vaccines, I only took the observations who answered "YES"

or “NO” for the question “has teen ever received any human papillomavirus shots?” The new data set had a sample size of N=9907 and weighed about 88.6% (Table 4) of the original subset. For the model selection in complex survey data, the chi-squared test which has been widely used for logistic regression model selection is not valid. The Wald tests were applied for hypothesis testing of the difference between models.

I used forward selection to build the model to answer the question “What is the relationship between mother’s education levels, marital status, and poverty status of family based on exact income, and the uptake of HPV vaccines for their adolescent male children?”. Since mother’s age did not show significant correlation with the outcome, I did not include it in the model selection. The below procedures were followed:

- Step 1. Starting with an empty Model 1.
- Step 2. Adding marital status of mother as the independent variable to build Model 2.
- Step 3. Using the Wald test to compare the Model 1 and Model 2, I got $F = 8.746$, and $p = 0.003$.
- Step 4. Adding mother’s education level as the independent variable to Model 2 to build Model 3.
- Step 5. Using the Wald test to compare Model 2 and Model 3, I got $F = 0.525$ and $p = 0.665$.
- Step 6. Adding poverty status of family as the independent variable to Model 2 to build Model 4.

- Step 7. Using the Wald test to compare Model 2 and Model 4, I got F = 0.548 and p = 0.649.

The Wald test results of step 3, step 5 and step 7 showed that male adolescents receiving HPV vaccines did differ by marital status of mother but did not differ by mother's education level or poverty status of family. The reasons why maternal education level or poverty status of family is significant in bivariate analysis but not in logistic regression model may be:

A correlation between the predictors. For example, the Wald test for the weighted cross frequencies (including territories): the mother's education level with 4 categories and marital status of mother found F = 63.334 and p<0.001. Hence, in the regression model, the two variables compete" for explaining the uptake of HPV vaccines for their adolescent male, which results in the variable losing its significant effect in the model.

The other reason is that the weighted method has lower statistical power (Bollen, 2016). I repeated the selection Step 1- Step 5 in a regular logistic model. The logistic model indicated the odds ratio of male adolescents taking HPV vaccines was significantly higher in maternal education level college graduate than maternal education level less than 12 years. Due to the correlation between the maternal educational level and marital status of mother and the research target population which is adolescent male teens in the U.S. I decided to use the weighted method and only keep the marital status of mother as a predictor in the model.

In model 1 (Table 10, Figure 1), I found that marital status of mother significantly predicted the likelihood of the uptake of HPV vaccines for male adolescents. Compared

to the teens who had a married mother, the teens whose mother had never married/ widowed/ divorced/ separated/ deceased/ living with partner had higher odds of receiving HPV vaccines (OR: 1.27; 95% CI: 1.08 – 1.49, p = 0.003).

Table 10

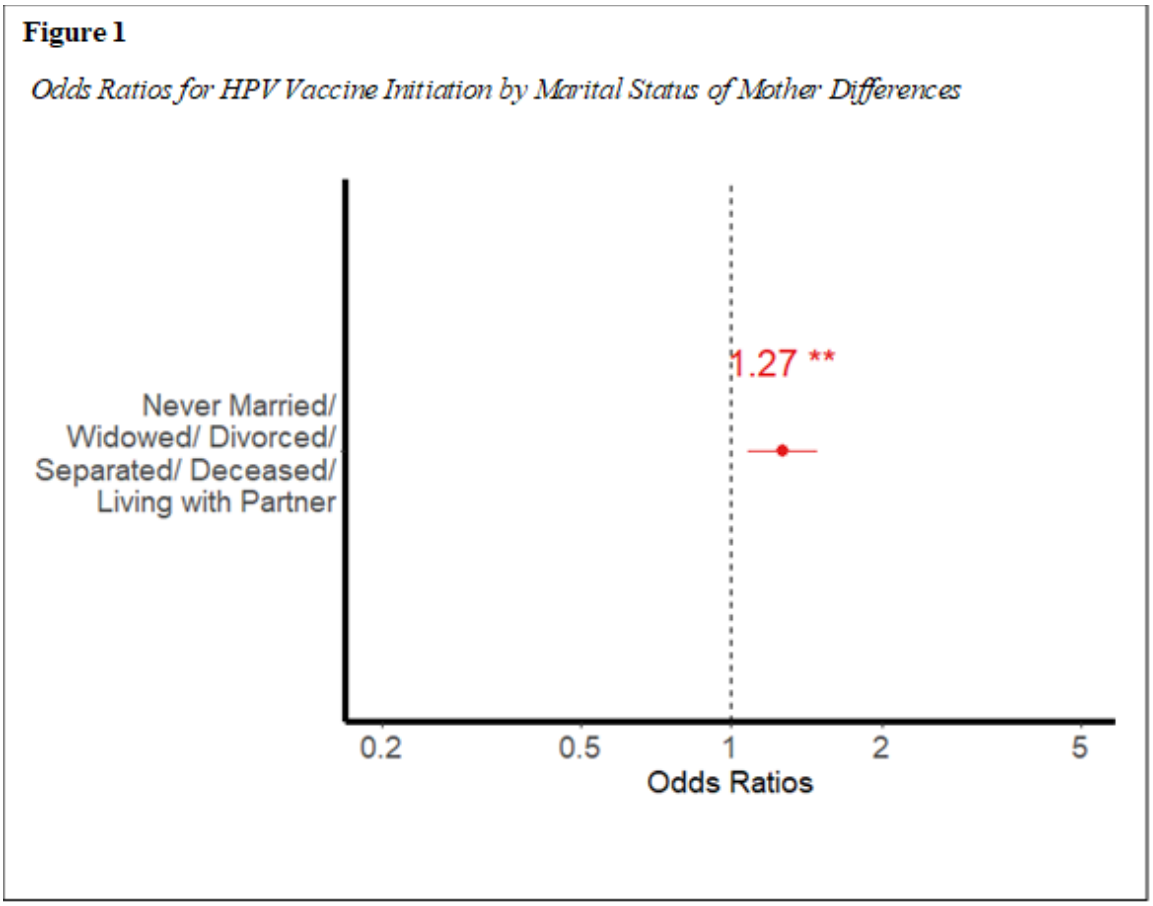
Weighted Logistic Regressions for Marital Status of Mother Differences in Adolescent Male HPV Vaccine Initiation

Predictors	Odds Ratios	95% CI	p
Never Married/Widowed/ Divorced/Separated/ Deceased/ Living with Partner	1.27	1.08 – 1.49	0.003

N=9907, Nagelkerke R2=0.003

Figure 1

Odds Ratios for HPV Vaccine Initiation by Marital Status of Mother Differences



Research Question 2

The second research question is: What is the relationship between parental decision making regarding vaccines as measured by uptake of other vaccines such as diphtheria, tetanus, and acellular pertussis (DTaP), and the uptake of HPV vaccines for their adolescent male children, after controlling for parental demographic variables (marital status of mother, mother's educational level, poverty status of family).

H02: There is no statistically significant relationship between parental decision making regarding vaccines as measured by uptake of other vaccines (Tdap) and uptake of HPV vaccines for their adolescent male child, after controlling for race, ethnicity, and education level.

Ha2: There is a statistically significant relationship between parental decision making regarding vaccines as measured by uptake of other vaccines (Tdap) and uptake of HPV vaccines for their adolescent male child, after controlling for race, ethnicity, and education level.

Univariate Analysis

To answer this research question, I also built a logistic regression model to evaluate the relationship between teen's odds ratio (OR) ever receiving any HPV shots and parental decision making regarding vaccines. In the model, the output is the same output variable in research question 1. The independent variable will be the "Has teen ever received any tetanus booster shots?" which measures parental decision making regarding vaccines. In Table 11, I showed the weighted frequencies of this independent variable. The model was adjusted for possible confounding factors, including all variables have a significant correlation with output in the bivariate analysis- marital status of mother, mother's education level, poverty status of family.

Table 11

Weighted Frequencies (Including Territories) of Tetanus Booster Shot Uptake

	Frequency	Percent
Yes	9460628	88.0%
No	481753	4.5%

Don’t Know	806590	7.5%
Refused	736	0.0%

Bivariate Analysis

For research question two, the F statistic for weighted cross frequencies (including territories): “has teen ever received any tetanus booster shots?” and “has teen ever received any human papillomavirus shots?” is F (9,11022) = 15.625 ($p < 0.001$) (Table 13). Together with the result of bivariate analysis of model 1, the p-values indicated that the adolescent male has ever received any human papillomavirus shots is correlated with the marital status of mother, mother’s education level, poverty status of family, parental decision making regarding vaccines.

Table 12

Weighted Cross Frequencies (Including Territories) of Tetanus Booster Shot Uptake and HPV Shots Uptake

Has teen ever received any tetanus booster shots?	Has teen ever received any human papillomavirus shots?				Total
	Yes	No	Don’t Know	Refused	
Yes	4665327 (49.3 %)	3871395 (40.9 %)	922750 (9.8 %)	1155 (0 %)	9460627 (100 %)
No	98846 (20.5 %)	344931 (71.6 %)	37976 (7.9 %)	0 (0 %)	481753 (100 %)
Don’t Know	264420 (32.8 %)	276499 (34.3 %)	265672 (32.9 %)	0 (0 %)	806591 (100 %)
Refused	0 (0 %)	0 (0 %)	0 (0 %)	736 (100 %)	736 (100 %)
Total	5028593 (46.8 %)	4492825 (41.8 %)	1226398 (11.4 %)	1891 (0 %)	10749707 (100 %)

$F=15.625 \cdot p<0.001$

Through the bivariate analysis, I found that parental decision making regarding vaccines is highly associated with HPV vaccine uptake. I will continue to check the correlation in the logistic model.

Multivariate Analysis

In answering the second research question, the below procedures were followed:

- Step 1. Starting with an empty Model 1.
- Step 2. Adding the independent variable parental decision making regarding vaccines which is measured by uptake of any tetanus booster shots to build Model 2.
- Step 3. Using the Wald test to compare the Model 1 and Model 2, I got $F = 32.138$ and $p<0.001$.
- Step 4. Adding marital status of mother as a covariate to Model 2 to build Model 3.
- Step 5. Using the Wald test to compare Model 2 and Model 3, I got $F = 11.049$ and $p = 0.001$.
- Step 6. Adding mother's education level as a covariate to Model 3 to build Model 4.
- Step 7. Using the Wald test to compare Model 3 and Model 4, I got $F = 0.564$ and $p = 0.639$.
- Step 8. Adding poverty status of family as a covariate to Model 3 to build Model 5.

- Step 7. Using the Wald test to compare Model 3 and Model 5, I got F = 1.186 and p = 0.313.

The final logistic regression model used to evaluate the relationship between teen's odds ratio (OR) ever receiving any HPV shots and parental decision making regarding vaccines is adjusted by the covariates the marital status of mother.

Parental decision-making regarding vaccines measured by uptake of other vaccines such as diphtheria, tetanus, and acellular pertussis (DTaP) significantly affected the odds ratios of the uptake of HPV vaccines for male adolescents. Also, in the unadjusted model (Table 15, Figure 2), teens who had ever received any tetanus booster shots (OR: 4.21; 95% CI: 2.95 – 5.99; p<0.001) had much higher odds of receiving HPV vaccines compared to teens who had never received tetanus booster shots. After controlling for marital status of mother, I found that parental decision making regarding vaccines still can be a predictor of the uptake of HPV vaccines for teens (Table 16, Figure 3). If holding the marital status of mother at the same level, the male adolescents whose parents had a positive attitude toward receiving vaccines still had much higher odds (OR: 4.49; 95% CI: 3.05 – 6.21; p<0.001) of receiving HPV vaccines compared to teens who had never received tetanus booster shots.

Table 13

Unadjusted Weighted Logistic Regressions for Parental Decision Making Regarding Vaccines Differences in Adolescent Male HPV Vaccine Initiation

Predictors	Odds Ratios	95% CI	p
Has teen ever received any tetanus booster shots: Yes	4.21	2.95 – 5.99	<0.001

Has teen ever received any tetanus booster shots: Don't Know	3.34	2.11 – 5.27	<0.001
N=9907, Nagelkerke R2=0.02.			

Figure 2

Odds Ratios for HPV Vaccine Initiation by Parental Decision Making Regarding Vaccines Differences (Unadjusted)

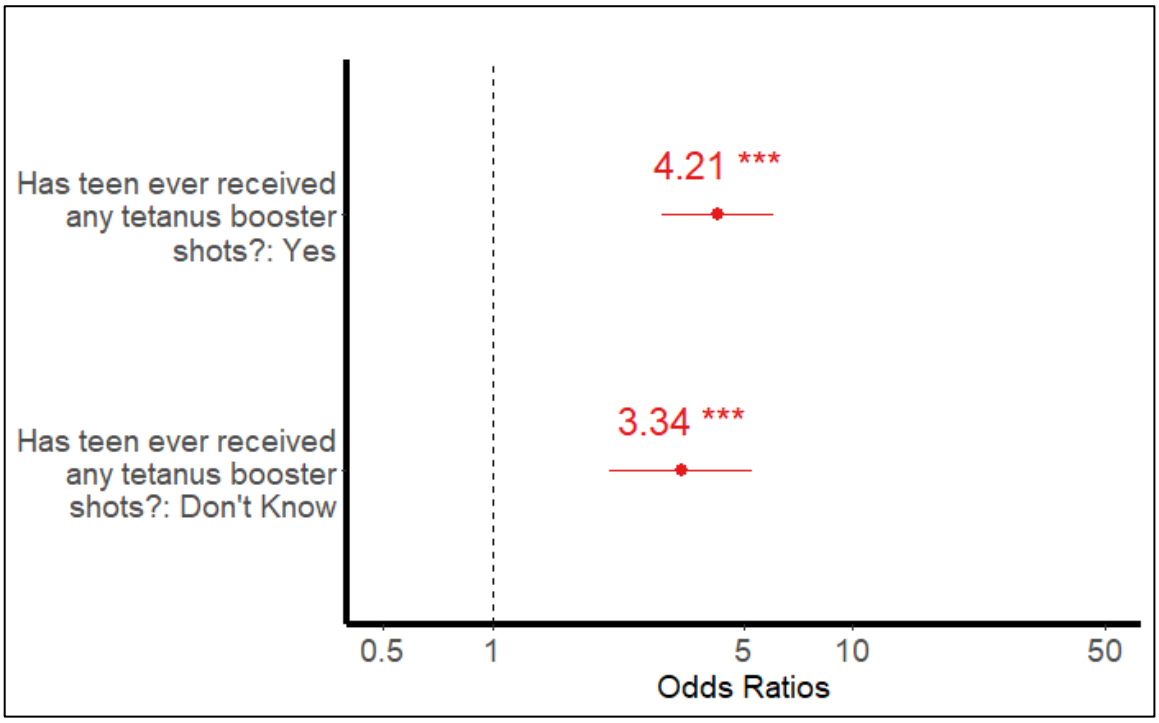


Table 14

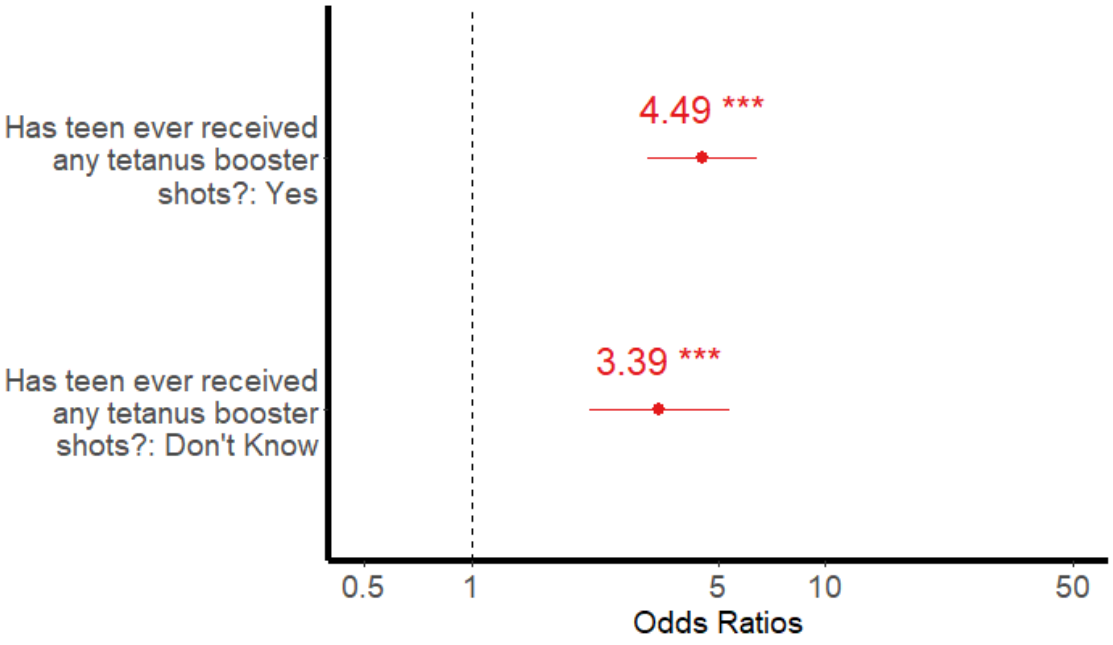
Adjusted Weighted Logistic Regressions for Parental Decision-Making Regarding Vaccines Differences in Adolescent Male HPV Vaccine Initiation

Predictors	Odds Ratios	95% CI	p
Has teen ever received any tetanus booster shots: Yes	4.49	3.05 – 6.21	<0.001

Has teen ever received any tetanus b0.-ooster shots: Don't Know	3.39	2.16 – 5.39	<0.001
N=9907, Nagelkerke R2=0.02.			

Figure 3

Odds Ratios for HPV Vaccine Initiation by Parental Decision Making Regarding Vaccines Differences (Adjusted)



Summary

In summary, I present the analytical results for the 2016 NIS-Teen survey data pertaining to parents' demographics and parental decision making in the uptake of the HPV vaccine among their adolescent male children ages 13-17 in the United States. A total of 11,022 male teens had more extensive data (e.g., provider-reported vaccination histories and facility data) with adequate provider information included in the data set. I

used weighted multiple logistic regression analysis to evaluate the relationship between the three variables of the marital status of mother, maternal education level, and parental decision making regarding vaccines as measured by uptake of diphtheria, tetanus, and acellular pertussis (DTaP), and the uptake of the HPV vaccine among male adolescents 13-17 years old in the US.

Based on the analysis results, I found a statistically significant relationship between the marital status of mother and HPV vaccination uptake such that the teens whose mother had never married/ widowed/ divorced/ separated/ deceased/ living with partner had higher odds of receiving HPV vaccines (OR: 1.27; 95% CI: 1.08 – 1.49, p=0.003). However, the association between maternal education level, poverty status of family and HPV vaccination uptake was not statistically significant in multivariate analysis but significant in bivariate analysis.

Further, multiple logistic regression analysis demonstrated that the male adolescents whose parents had a positive attitude toward receiving vaccines had had much higher odds (OR: 4.49; 95% CI: 3.05 – 6.21; p<0.001) of receiving HPV vaccines compared to teens who had never received tetanus booster shots after controlling for the marital status of mother. Therefore, I accepted the alternative hypothesis that parental decision making regarding vaccines significantly affected the odds ratios of the uptake of HPV vaccines for male adolescents. In the next and final chapter of this dissertation, I will discuss my research findings, their potential application to future investigation, and implications for relevant professional practice and positive social change.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

Recent data have shown that just over half of U.S. teens were up to date on HPV vaccination. HPV vaccination, which has been shown to protect against several types of cancers, continues to lag far behind other vaccines recommended for adolescents and does not meet the Healthy People 2030 goals of an 80% vaccination rate (Walker et al., 2019). Girls continue to be vaccinated at a higher rate than boys. An estimated 53.7% of girls were up to date on the HPV vaccine, whereas among boys, only 48.7% were fully vaccinated in 2017. To gather valuable information that could improve HPV vaccination programs for male adolescents, I investigated the association between parents' sociodemographics and parental decision making in the uptake of the HPV vaccine among their adolescent male children ages 13–17 in the United States by analyzing 2016 NIS-Teen survey data. The aim of the study was to gather information about parent-related factors and their connection to HPV vaccine series acceptance. I looked at secondary data from the NIS-Teen public-use survey data set from 2016. The data were analyzed using R-4.0.5 for Windows, which included univariate, bivariate, and multivariate analyses.

There were two major research questions in this analysis. The first was the impact of parents' sociodemographics and parental decision making regarding vaccines on the uptake of the HPV vaccine among their adolescent male children ages 13–17 in the United States. A total of 11,022 male teens had extensive data (e.g., provider-reported

vaccination histories and facility data) with adequate provider information in 2016 NIS-Teen survey data included as observation.

I built two weighted logistic regression models to evaluate the relationship between three parent sociodemographic variables: marital status of the mother, maternal education level, poverty status of the family, and uptake of the HPV vaccine among male adolescents 13–17 years old in the United States. I found a statistically significant relationship between the marital status of the mother and HPV vaccination uptake. The teens whose mother had never married/widowed/divorced/separated/deceased/living with partner had higher odds of receiving HPV vaccines (OR: 1.27; 95% CI: 1.08 – 1.49, p = 0.003) than married mothers. However, the associations between maternal education level, poverty status of the family, and HPV vaccination uptake were not statistically significant in the multiple logistic regression model.

For the second research question, a multivariate logistic regression analysis demonstrated that parental decision making regarding vaccines significantly affected the odds of uptake of HPV vaccines for adolescent male children. After controlling for parents' sociodemographics, teenage male adolescents whose parents had a positive attitude toward receiving vaccines had nearly four times higher odds of uptake of HPV vaccines (OR: 1.42 vs. 0.07) than their counterparts.

Interpretation of the Findings

Maternal Marital Status

I found that mothers' marital status can predict the likelihood of uptake of HPV vaccines for male adolescents. Compared to teens who had a married mother, teens

whose mother had never married/widowed/divorced/separated/deceased/living with partner had higher odds of receiving HPV vaccines (OR: 1.27; 95% CI: 1.08 – 1.49, p = 0.003).

My study was consistent with recent research on NIS–Teen 2014 data (Landis et al., 2018). Landis et al. also reported marital status of the mother was significantly associated with HPV vaccine initiation. Some reports have shown that women living with a partner or single women were considerably more likely than married women to be interested in the HPV vaccine after controlling for sociodemographic and other known risk factors. Women who were married were more likely to cite not needing the vaccine compared to never-married women (Thompson et al., 2017). Hollins et al. (2021) also found that undergraduate nurse students who were married or living with a partner were less likely to have completed the HPV vaccine series (Hollins et al., 2021). Women in stable relationships perceived the risk of HPV to be low, which they attributed to monogamy and few sexual partners (Thompson et al., 2017). These findings also provide a rational explanation for the results from my logistic regression model, which showed that the mother's marital status impacted the uptake of HPV vaccines for her adolescent male child.

Poverty Status of Family

Family income was associated with male adolescents' HPV vaccination uptake in the United States based on bivariate analysis of the NIS-teen 2016 data F (9,11022) = 2.964, p = 0.002). Landis et al. (2018) obtained similar results in the NIS-teen 2014 data. Musto and colleagues (2013) also found that participant neighborhood socioeconomic

status was positively related to the likelihood of being HPV vaccinated. However, Bednarczyk et al. (2014) found that adolescents living below the poverty level had higher HPV vaccination initiation than adolescents living above the poverty level. These findings differ from the results from my logistic regression model, which showed that family poverty status did not significantly affect the HPV vaccination uptake of teens $F(3,9903) = 1.70$, $p = 0.165$).

Two main factors may explain the difference between bivariate analysis and logistic regression; first is the reduced power of weighted analysis. I repeated the forward selection steps in a regular logistic model. The logistic model indicated the odds ratio of male adolescents taking HPV vaccines was significantly higher in maternal education level of college graduate than maternal education level of less than 12 years. The inconsistency of bivariate analysis and modeling may be due to the weighted analysis method (Bollen, 2016). However, as the NIS data are complex weighted survey data, survey-weighted logistic regression model would be a fitter method. Therefore, I kept the weighted logistic regression result. The other explanation could be the correlative relationship among the predictors. For example, the Wald test for the weighted cross frequencies (including territories): the mother's education level with four categories and marital status of mother found $F = 63.334$ and $p < 0.001$. Hence, in the regression model, the two variables compete for explaining the uptake of HPV vaccines for their male adolescent, which results in the variable losing its significant effect in the model. Although not substantial in the logistic model, my bivariate analysis result extends the

knowledge of maternal income as a possible predictor variable of HPV vaccine uptake and justifies further research in this regard.

Maternal Education

Female adolescents who postponed HPV vaccination were more likely to be White, come from higher-income families, and have mothers with college degrees, according to Dorell et al., 2014). Also, Feiring et al. (2015), discovered a connection between higher maternal education and a lower likelihood of starting the vaccine sequence. Lower schooling, on the other hand, was linked to a higher chance of starting the vaccine sequence. Other research, on the other hand, has linked a higher level of education to increased HPV vaccine uptake. According to Yu et al. (2016), older daughters, higher wages, and a higher level of education were all linked to improved vaccine acceptability. In an analysis of the NIS-teen 2016 public-use data set, I discovered that maternal education level was linked to their male adolescents' HPV vaccination uptake in the United States $F(9,1102) = 5.029$, $p < 0.001$). Despite the fact, that the teen community with the lowest mother's education level (less than 12 years) seemed to have the highest odds ratio of HPV vaccine uptake, I failed to reject the null hypothesis in the multivariate logistic regression model at $\alpha = 0.05$ level. Based on these conflicting findings in the literature, as well as my finding of a non-significant relationship between maternal education and HPV uptake, I recommend further research into the function of maternal education as a predictor of HPV vaccination in male adolescents.

Parental Decision Making

My analysis showed that parental decision making regarding vaccines measured by uptake of other vaccines such as diphtheria, tetanus, and acellular pertussis (DTaP) significantly affected the odds of the uptake of HPV vaccines for male adolescents, even after controlling for the parental socio-demographic's variables (OR: 4.49, $p<0.001$). Parental decision making has been shown to be an important factor affecting HPV vaccination among teen girls. Information on factors affecting parental decisions about vaccination will facilitate the development of successful interventions. Moreover, interventions should address parental concerns about vaccine safety, consequences, reduce structural barriers, and promote the perception that vaccination is endorsed by significant others (Allen et al., 2010). Furthermore, interventions may need to address mistrust of the efficacy of HPV vaccines and pharmaceutical companies. The result of my work was consistent with previous research by Krawczyk et al. (2015), which showed that parents' general vaccination attitudes and adherence to other routinely recommended vaccines played a positive influence on HPV vaccination among teen girls. Work by Waller et al. (2020) suggested that parental decision making regarding HPV vaccines might differ for boys from girls. Parents of girls were more willing to vaccinate than boys, with an adjusted odds ratio of 1.80 (1.32-2.45). In addition, positive attitudes and HPV/vaccine awareness were significantly independently associated with the decision to vaccinate, suggesting a need for public health campaigns to raise awareness in parents to extend HPV vaccination to boys (Waller et al., 2020).

Conceptual Framework

Relationships between health values and health habits may be influenced or moderated by parental socio-demographic factors and vaccine decision making (Rosenthal et al., 2008; Sisson & Wilkinson, 2019). I discovered evidence that the mother's marital status was correlated with HPV vaccination uptake by male adolescents using the HBM in this research, but not other parental socio-demographic variables examined, such as family poverty status, and maternal education level. The various socio-demographic variables can modulate relationships between health beliefs and health behaviors, according to the HBM constructs (Skinner et al., 2015). In my study, the modifying factor maternal marital status was found to be a major predictor of HPV vaccine uptake. This was a secondary data study that inferred that the mother's marital status influenced her understanding of HPV infection susceptibility/risk. More research is needed to specifically test the perception of HPV infection susceptibility/risk as well as the possibility of maternal marital status moderating perception. Perceived susceptibility was found to be an important factor in the implementation of preventative health behaviors in the HBM. My research also discovered that parental vaccination decisions are influenced by the uptake of other vaccines such as tetanus, diphtheria, and acellular pertussis (Tdap) even after adjusting for the parental socio-demographic's variables, the odds ratios of HPV vaccine uptake for male adolescents were significantly affected, bolstering the HBM idea that a well-perceived potential danger and well-informed net advantage could urge people to act (Jones et al., 2015). The successful use of the HBM constructs during the redesign of an HPV immunization program could increase HPV

vaccination coverage across various demographic groups and regions in the United States. HBM construct-driven vaccination programs that are effectively tailored to populations and regions based on demographic factors and parental obstacles could have a positive effect on HPV vaccine coverage in a wide variety of communities in the United States.

Limitations of the Study

There are some limitations for this study. Firstly, the most significant limitation is the partial coverage of the secondary data. The data used in this study were obtained as part of the 2016 NIS-Teen survey of 13-17-year-old male adolescents in the United States for immunization coverage estimates. The data from U.S. Virgin Islands and Guam were not included in the 2016 public-use data file to protect confidentiality. So, the results do not represent the entire U.S. teen population. However, the CDC used random digit dialing methods and chance sampling improvements to reduce the risk of sampling biases in the qualifying population. In addition, I used the weighted-survey analysis method to study the data, the results can be considered generalizable to all 13–17-year-old male adolescents in the United States.

Secondly, NIS-Teen has historically had poor response rates on landlines and cellphones (68% and 23%, respectively). Although those rates are comparable to other nationwide telephone-based surveys, the findings may be tilted because parents who engage in health-seeking activities are more likely to participate (Landis et al., 2018). On the other hand, adolescents with institutionalized guardians, for example, did not have data collected because their guardians did not have a mobile phone or landline number.

The research is also susceptible to parent recall bias due to the self-reported nature of provider recommendations. For example, there are a significant proportion (7.5%) of parents answered “Don’t know” when they were being asked, “has teen ever received any tetanus booster shots?” This percentage was even higher than the parents answered “No” (4.5%) for the tetanus booster shots. And the OR of taking HPV vaccine in the “Don’t know” group is higher than the “No” group but lower than the “Yes” group indicated the “Don’t know” group is mixed. This uncertainty of data may cause the inaccuracy of the analysis results.

Thirdly, since the information in the secondary data set was not collected specifically for the HPV vaccination analysis, this may also limit this study. For instance, due to limited sample sizes in particular variables or chosen local areas, there is a risk that estimates will be skewed (Reagan-Steiner et al., 2015).

Other limitations make it difficult to draw causal inferences and apply the findings to the entire United States teen population. Overall, unknown confounders could be influencing the relationship between the independent and dependent variables; these could be further obscured by aggregate data, not currently measurable, or in flux within complex processes affecting health and health outcomes. For example, family income was associated with male adolescents’ HPV vaccination uptake in the United States based on bivariate analysis of the NIS-teen 2016 data $F(9,11022) = 2.964$, $p = 0.002$) in this study. However, this finding differs from logistic regression model which showed that family poverty status did not significantly affect the HPV vaccination uptake of male teens $F(3,9903) = 1.70$, $p = 0.165$). This could be explained by different analyzing

methodologies (weighted versus unweighted) and correlative/competitive relationship among variables. The lack of measures on the health status of both children and parents/guardians, vaccination intentions, and vaccine expectations are some of the data set's limitations. Lastly, the NIS-Teen sample does not include 11–12-year-old, another important target group for HPV vaccination.

Recommendations

Only the NIS-Teen 2016 data set was used in my current data analysis. To be more rigorous in the research process and more involved in the entire teen HPV vaccination development, data sets from previous years should be quantitatively researched to compare or include additional details about parental factors that may influence teen male vaccination. Further research using an HPV vaccine customized instrument grounded in the HBM constructs to examine parents' socio-demographics, particularly some ignored variables, and uptake of the HPV vaccine by male adolescents is highly recommended, as this was secondary data analysis. In-depth interviews and focus group discussions are another choice for further study and analyzing the answers of the participants on a qualitative level. More rigorous research is needed to enhance understanding of parental factors that affect vaccination and reduce or even remove some of the inconsistencies, as shown by the contradictions in parental socioeconomic status/education level associations with teen HPV vaccination in previous research. Finally, studies combining mixed techniques, qualitative and quantitative approaches, as well as responses obtained by primary researchers investigating the same parental

variables, may provide additional knowledge that could help researchers advance their current research goals.

Implications

This study identified maternal marital status and parental decision making regarding vaccines as important factors in HPV vaccination of male adolescents. My work examined factors of the HBM via secondary data analysis to look at predictors of HPV vaccination. The findings promote discussion and modification of applicable HPV vaccine policies, as well as hints for potential research process design. Most significantly, the research provided in this work encourages individuals and societies to make meaningful improvements.

Professional Practice

This study provides valuable information gathered through the process of secondary data analysis. Regarding professional practice, my work demonstrated that it is worthy educating pediatricians about the importance of encouraging mothers, particularly married mothers, to vaccinate their male adolescents. The findings from this research could also be used by primary care providers in the enhancement of general vaccine educational programs for parents, shifting their attitude towards general vaccination to promote HPV vaccine acceptability. In addition, the results from this study could be used to develop activities by local communities such as schools and churches to spread the information in targeted populations about HPV risk and the benefit of vaccination to improve uptake of the HPV vaccine series by male adolescents. Finally, the findings of this study could be utilized by the media and HPV advocates to spread knowledge of

HPV and its vaccine based on evidenced-based predictors, such as maternal marital status and parental acceptability of other vaccines to improve the HPV vaccination uptake rate among male adolescents.

Positive Social Change

The aim of this study was to fill gaps in the literature left by previous studies on the role of parents and their adolescent male child's HPV vaccine uptake. Mother's marital status and parents' vaccine decision making in general were two major predictors of HPV vaccine uptake among male adolescents in this study and were more predictive than maternal level of education and family income. This study's findings could help to enhance HPV vaccine services aimed at raising adolescent male vaccine coverage in order to reach the Healthy People 2030 goals. Through using these results to redesign, complement, or improve HPV vaccine services, the overall morbidity and mortality from HPV-related cancers in the United States may be reduced.

Conclusion

The results of this study showed that: (a) there is a statistically significant association between a mother's marital status and HPV vaccination uptake, with teen boys whose mothers were never married, widowed, divorced, separated, deceased, or living with a spouse having a higher likelihood of receiving HPV vaccines (OR: 1.27; 95% CI: 1.08 – 1.49, p=0.003) than married mothers, (b) male adolescents whose parents had a positive attitude toward receiving vaccines had nearly 20 times higher odds of uptake HPV vaccines compared to their counterparts whose parents had never taken them to get a tetanus booster shot even after controlling for the marital status of mother (OR:

4.49, $p<0.001$). Vaccination to prevent HPV infection and subsequent related cancers should remain a high public health priority. More work is needed to fill knowledge gaps regarding uptake of the HPV vaccine series by different groups in the United States. The evidence presented in this study could be used to enhance educational programs for parents of male adolescents and healthcare workers, ultimately making a positive impact on social change by improving vaccination rates, increasing prevention of HPV, and reducing the overall incidence of HPV-related cancers in the United States.

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