Distribution Agreement

In presenting this thesis or dissertation as a partial fulfillment of the requirements for an advanced degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my thesis or dissertation in whole or in part in all forms of media, now or hereafter known, including display on the world wide web. I understand that I may select some access restrictions as part of the online submission of this thesis or dissertation. I retain all ownership rights to the copyright of the thesis or dissertation. I also retain the right to use in future works (such as articles or books) all or part of this thesis or dissertation.

Signature:

_____ _____

Samantha Jacobs Date

Assessing Parental Attitudes and Sources of Information that Influence Adolescent Uptake of Human Papillomavirus (HPV) Vaccine in Richmond County, Georgia

By

Samantha Jacobs
MPH

Behavioral Sciences and Health Education

_____

Jessica M. Sales
Committee Chair

_____

James M. Hughes
Committee Member

_____

Richard M. Levinson
Department Chair

Assessing Parental Attitudes and Sources of Information that Influence Adolescent Uptake of Human Papillomavirus (HPV) Vaccine in Richmond County, Georgia

By

Samantha Jacobs

B.S. Health, Physical Education and Exercise Science
Virginia Commonwealth University
2010

Thesis Committee Chair: Jessica McDermott Sales, PhD, MA

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health at Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Behavioral Sciences and Health Education
2014

Abstract

Assessing Parental Attitudes and Sources of Information that Influence Adolescent Uptake of Human Papillomavirus (HPV) Vaccine in Richmond County, Georgia
By Samantha Jacobs

The Advisory Committee on Immunization Practices recommends human papillomavirus (HPV) vaccination for adolescents. Since its introduction into the routine immunization schedule, HPV vaccine uptake has been extremely low nationwide. This study aimed to assess how sources of information and parental attitudes were associated with adolescent HPV vaccine uptake in Richmond County, GA. From March-July of 2013, a cross-sectional survey was administered to parents of middle- and high-school students who participated in a study designed to enhance adolescent immunization uptake (N=129). Guided by the Health Belief Model and the Integrated Behavioral Model, survey items measured perceived susceptibility, perceived severity, perceived benefits, and social norms. Attitude items were combined to form a total HPV vaccine attitude score. The survey asked about sources of HPV vaccine information; each source contributed 1 point towards a total HPV vaccine information source score (range: 0-8). A majority of students inquired about in the survey were African-American and insured by Medicaid. Vaccine receipt was higher in this sample than national estimates, along with a high reported frequency of physician recommendation. Main findings from this study demonstrated that receipt of at least 1 dose of HPV vaccine was significantly associated with a greater number of sources where one heard about HPV vaccine, higher HPV vaccine attitude score, and recommendation from a health care provider. Parents heard about HPV vaccine from an average of 4.2 sources; doctor/medical professional was the most frequently reported source, followed by TV and drug advertisements. In bivariate analyses, hearing about HPV vaccine from a doctor/medical professional, TV, and radio were significantly associated with vaccine uptake. Mediation analyses suggested that parental attitudes explain, in part, the association between a greater number of HPV vaccine information source exposures and HPV vaccine uptake. In this sample, exposure to HPV vaccine information was high and attitudes were largely positive. This study demonstrates that broadcast media may be an appropriate communication channel for this population, whereas Internet is less supported. Communication mechanisms should be selected carefully and include messages that enhance positive attitudes towards HPV immunization.

Assessing Parental Attitudes and Sources of Information that Influence Adolescent Uptake of Human Papillomavirus (HPV) Vaccine in Richmond County, Georgia

By

Samantha Jacobs

B.S. Health, Physical Education and Exercise Science
Virginia Commonwealth University
2010

Thesis Committee Chair: Jessica McDermott Sales, PhD, MA

A thesis submitted to the Faculty of the
Rollins School of Public Health at Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Behavioral Sciences and Health Education
2014

Acknowledgements

First and foremost I want to express my sincere gratitude to my Thesis Committee Chair and academic advisor, Dr. Jessica Sales. I am extremely grateful that Dr. Sales invited me to utilize the research she conducted with esteemed colleagues at the Emory Vaccine Center and the East Central Health District. Dr. Sales' continued guidance and support was instrumental in the success of this project. I would also like to thank Thesis Committee member Dr. James Hughes for his mentorship throughout this process. I am thankful for Dr. Hughes' supervision in all stages of this work, from development of the research questions to detailed feedback of my writing. In addition, it was a pleasure to collaborate with the entire team at the Emory Vaccine Center. In particular, I would like to thank Lisa Gargano, Katy Seib, and Natasha Herbert for orienting me to the study and providing continued assistance throughout the entire project. I also have these team members to thank for doing such a wonderful job collecting, managing, and gathering the data I used. Furthermore, I would like to thank members of the larger research team for their roles in conducting the parent study over the last several years. Partners at the East Central Health District, Georgia Department of Health and Richmond County Schools were crucial in the successful implementation of this study. I truly appreciate all teachers, students, and parents in Richmond County who participated in this study. I hope that my findings will benefit this community in the future.

Lastly, I would like to thank my family and friends for challenging me to achieve success with my academic goals and beyond. I am grateful for so many inspiring friends, classmates, and faculty members at RSPH who have set the bar quite high and supported me along the way.

Table of Contents

Table of Contents: Figures, Appendices and Tables

CHAPTER I. INTRODUCTION

Human papillomavirus (HPV) causes a sexually transmitted infection that results in approximately 14 million new infections in the U.S. each year. HPV is so pervasive that an individual's lifetime risk of acquiring the infection is greater than 50% (CDC, 2013a; Gillison, 2012; Hariri et al., 2011). HPV is transmitted through genital contact, most often during vaginal and anal intercourse. HPV can also be passed on during oral sex and genital-to-genital contact (CDC, 2013a). There are over 100 strains of HPV, although only 40 types contribute to clinical disease. Infections with high-risk strains of HPV (such as types 16 and 18) have been associated with cancers of the cervix, anus, penis, vagina, vulva, and oropharynx. HPV is thought to be responsible for more than 90% of anal and cervical cancers, and greater than half of vaginal, vulvar, and penile cancers. Cervical cancer is the most common HPV-associated cancer among women, with an average of 11,967 cases occurring annually in the U.S. Cancer of the cervix is most frequently diagnosed among women aged 35-44 and has a 5-year survival rate of 67.9%. It is estimated that in 2013 there will be 4,030 deaths from cervical cancer (National Cancer Institute, 2014).

Oropharyngeal cancer is the second most common HPV-associated cancer in the U.S., with an average of 2,370 cases attributed to HPV occurring annually among females and 9,356 among males (CDC, 2012). Population based cancer registries have shown significant increases in the incidence of oropharyngeal and anal cancers in men since the late 1980's, and it has been estimated that by 2020, HPV will cause more oropharyngeal cancers than cervical cancers in the U.S. (Chaturvedi et al., 2011).

In both men and women, non-oncogenic, or low-risk HPV types, such as HPV 6 or 11, can cause benign or low-grade abnormalities of the cervix, genital warts, and a disease of the respiratory tract called recurrent respiratory papillomatosis (Lacey, Lowndes, & Shah, 2006). However, the majority of HPV infections will not produce symptoms, often resolving in the individual without any awareness of the infection.

Particularly for the outcome of cervical cancer, substantial racial, ethnic, and socioeconomic disparities exist. Black and Hispanic women consistently demonstrate higher incidence and mortality rates from cervical cancer compared to whites (National Cancer Institute, 2014). Low-income women have a higher prevalence of HPV infection, are more likely to be diagnosed with advanced stage cervical cancer, and have lower rates of surviving metastatic disease (Arnold, 2012; Hariri et al., 2011; Jeudin, Liveright, Del Carmen, & Perkins, 2013). Some of the disparities in HPV infection are likely attributed to differences in age of sexual debut and number of lifetime partners between racial, ethnic, and income groups (Akers, Newmann, & Smith, 2007; Eaton et al., 2012). Other consequences related to racial and income disparities such as reduced access to screening and early treatment underscore the need for effective prevention strategies.

HPV Vaccine as Primary Prevention

The best hope for reducing the incidence of HPV is through vaccination of adolescents before they become sexually active. There are currently two Food and Drug Administration (FDA) approved vaccines on the market in the U.S. that protect against HPV. A summary of the two licensed vaccines is provided below (FDA, 2011).

Quadrivalent HPV Vaccine (HPV4) "Gardasil," Merck	Bivalent HPV Vaccine (HPV2) "Cervarix," GlaxoSmithKline
Protects against HPV types 6, 11, 16, and 18.	Protects against high-risk types 16 and 18 only.
First FDA approval in June 2006 for females aged 9-26. Indication expanded to males aged 9-26 in 2009.	First FDA approval in October 2009 for females aged 9-26.
Currently recommended for females and males aged 11 or 12. Vaccination series can be started beginning at age 9 years. Catch-up vaccination recommended for females aged 13-26 and males aged 13-21 who have not been vaccinated previously or who have not completed the 3-dose series. Males ages 22-26 may be vaccinated.	Currently recommended only for females, aged 11 or 12. Catch-up vaccination recommended for females aged 13-26 who have not been vaccinated or who have not completed the 3-dose series.

Previously recommended for routine use among female adolescents only, the Advisory Committee on Immunization Practices (ACIP) currently recommends routine vaccination with HPV vaccine for females and males aged 11-12 years old on a 3-dose schedule at 0, 1-2, and 6 months. Either HPV4 or HPV2 may be used for females, and only HPV4 may be used for males. Catch-up vaccination with HPV vaccine is recommended for males and females who did not get the vaccine when they were younger, teen girls and young women through age 26, as well as teen boys and young men through age 21. HPV4 may be given to men 22 through 26 years of age who have not completed the 3-dose series, and is recommended for men through age 26 who have sex with men or whose immune system is weakened because of HIV infection, other illness, or medication (CDC, 2011).

The clinical trials that supported FDA approval demonstrated strong safety and efficacy of both HPV4 and HPV2, and they have continued to perform well in the postmarket setting (Dillner et al., 2010; Giuliano et al., 2008; Kjaer et al., 2009; Palefsky et al., 2011;

Szarewski et al., 2012). Globally, more than 175 million doses of HPV vaccine have been distributed. Although the licensed HPV vaccines are regarded as safe for use, it is important to acknowledge that adverse events can occur after any immunization. Many surveillance systems are in place to evaluate the continued safety of vaccines, including HPV2 and HPV4. Data from randomized controlled clinical trials, adverse events reporting systems, post-licensure passive and active surveillance systems, and population-based epidemiologic surveillance studies have provided robust evidence for HPV vaccine safety. The most common adverse events associated with HPV vaccines are injection site reactions such as redness, swelling, and pain, which usually last a short period of time and resolve spontaneously. Other severe adverse events that have been attributed to the vaccine are syncope and anaphylaxis; however, these events are rare, and not any more common than rates reported with other vaccines. No deaths have ever been attributed to the vaccine (Macartney, Chiu, Georgousakis, & Brotherton, 2013). In addition to continued safety monitoring and evaluation by U.S. bodies such as the Centers for Disease Control and Prevention (CDC), FDA, and ACIP, important international bodies such as the International Federation of Gynecology and Obstetrics and the World Health Organization's Global Advisory Committee on Vaccine Safety have reviewed the available evidence and maintain the position that both commercially available vaccines are safe (Denny, 2013). Federal law requires that health care staff provide a *Vaccine Information Statement* (VIS) to a patient, parent, or legal representative before vaccination. VIS contain a plain-language description of the risks associated with the vaccine, along with information about reporting adverse events and the National Vaccine Injury Compensation Program.

HPV Vaccine Coverage Rates

Despite the endorsement and explicit recommendation of HPV immunization by governing bodies and experts in the field, vaccine coverage rates for both female and male adolescents have been extremely low since their introduction into the routine childhood immunization schedule. CDC monitors vaccination coverage of all recommended adolescent vaccines through the National Immunization Survey--Teen (NIS-Teen), a telephone survey of parents or guardians of teens aged 13-17 years, coupled with a mailed questionnaire to vaccination providers identified by the parent or guardian. From 2007-2011, HPV vaccination among females with at least one dose increased on average 6.1 percentage points each year (CI=3.3–8.9), which demonstrated a lag behind two other adolescent vaccines, the combined Tetanus, Diphtheria, Pertussis vaccine (Tdap) and the meningococcal conjugate vaccine (MenACWY). The latest annual estimates from the 2012 NIS-Teen survey included 19,199 adolescents (9,058 females and 10,141 males). From 2011 to 2012, vaccination with one or more doses of HPV vaccine among females aged 13-17 years was 53.8% (±1.9), and 3-dose coverage was 33.4% (±1.7), which was largely unchanged from the year before. Although data for male coverage has been reported for less time due to its more recent approval for use, coverage among males aged 13-17 with one or more doses of HPV vaccine increased from 8.3% in 2010-2011 to 20.8% in 2011-2012. Three-dose coverage for males was 6.8% in 2011-2012, compared to 1.3% in 2010-2011(CDC, 2013c).

Trends in HPV vaccine uptake have been consistently lowest among southern states. Georgia has one of the lowest rates of uptake in the U.S.: from 2011-2012 vaccination with at least one dose among females aged 13-17 was 52.3% (±10.8), and 3-dose coverage was 29% (±9.0). Coverage of males with at least one dose of HPV vaccine in the 13-17 age range is approaching the national average at 19.5% (±8.5), which represents a statistically significant

percentage point increase from 2010-2011. No data are available yet for 3-dose coverage among males, but receipt of at least two doses was 8.7% (±4.7) (CDC, 2013c).

Immunization with routinely recommended childhood vaccines is largely achieved through regular well-child checkups. Most pre-teens and teens do not interact regularly with the health care system; thus, optimizing the opportunity for a health care provider to recommend HPV vaccination or offer the vaccine is of critical importance. Research suggests that there are numerous missed clinical opportunities for HPV vaccination, particularly for early adolescent females (Vadaparampil et al., 2011). CDC estimates that if all missed opportunities were eliminated, vaccination coverage with at least one dose of HPV vaccine would reach nearly 93% (CDC, 2013b).

Racial, Ethnic, and Income Disparities in HPV Vaccine Uptake

Current trends in the U.S. demonstrate disparities in vaccine uptake among minority and low-income adolescents (CDC, 2013c; Jeudin et al., 2013). Trends over the last several years show that minority and low-income adolescents have been either equally or more likely to initiate the HPV vaccine series than their white and higher-income counterparts, but have been less likely to receive all three doses (Bednarczyk, Curran, Orenstein, & Omer, 2013; Chou, Krill, Horton, Barat, & Trimble, 2011; Jeudin, Liveright, Del Carmen, & Perkins, 2014). From 2008 to 2011, HPV vaccine series initiation was consistently highest for Hispanic adolescents, followed by black adolescents, followed by whites. The trend demonstrated with HPV vaccine is the only routinely recommended adolescent vaccine to exhibit this atypical pattern. Epidemiologists suggest the trend of lower series initiation among higher-income white adolescents could be related to findings that mothers who were white, college educated, and had higher income had greater rates of active refusal of all

childhood vaccines. Furthermore, higher-income white adolescents may have greater access to routine cervical cancer screening, leading to a lowered perceived need for the HPV vaccine in favor of secondary prevention (Bednarczyk et al., 2013). Researchers also hypothesize that low-income mothers may view HPV vaccination positively due to more personal experiences with cervical cancer, leading to vaccination of their children (Gainforth, Cao, & Latimer-Cheung, 2012; Perkins, Pierre-Joseph, Marquez, Iloka, & Clark, 2010). Qualitative research findings have demonstrated that African-American mothers were motivated to vaccinate their daughters due to personal experiences with cervical cancer, anticipation of the sexual debut of their adolescent daughters, and a desire to utilize available healthcare interventions to protect their daughters (Hamlish, Clarke, & Alexander, 2012). At the same time, series completion has been higher among those living at or above the poverty level (CDC, 2013c), which is more consistent with known health disparities related to access issues. Differences exhibited between series initiation and series completion according to racial, ethnic, and socioeconomic status may be reflective of factors that correlate with whether or not an adolescent has a "medical home."

Factors Contributing to Low HPV Vaccine Uptake

Characterizing the determinants of HPV vaccination behavior is crucial to improving coverage rates. The early days following HPV vaccine approval in the U.S were met with controversy stemming from concerned parents and social conservatives. Critics of HPV immunization felt that giving adolescent girls HPV vaccine implied consent to engage in sexual activity, along with the idea that giving the vaccine would confer a false sense of protection from sexually transmitted infections, which would lead to risky sexual behavior.

Other opponents believed that children already had too many vaccinations on the immunization schedule, felt the vaccine was "too new" to feel comfortable with the long-term safety and effectiveness, or were deterred by considerations of state mandates (Haber, Malow, & Zimet, 2007; Ohri, 2007). Because adolescent HPV vaccination often (but not in all states) requires parental consent, parental beliefs and attitudes towards vaccination are an important component of understanding vaccination uptake.

Research suggests that parental attitudes are important determinants of HPV vaccine uptake; therefore, it is important to determine how parental perceptions about HPV vaccination are shaped and maintained, and how this affects decision-making about getting their child vaccinated. The beliefs that parents hold about HPV vaccination may be influenced by any number of factors, such as religious or political leanings. For some parents, the extent of exposure they have had to information about HPV vaccine may be the first step in shaping their perceptions about the vaccine, although some parents may not have been exposed to information about HPV vaccine at all. Messages about health behaviors are being increasingly disseminated through mass media communications. Regulatory agencies, pharmaceutical companies, and advocacy groups alike use a variety of media platforms, including television, radio, and the Internet to spread information about vaccines to a wide range of audiences. News stories about vaccines can be picked up by a variety of media sources including print and online newspapers, magazines, blogs, social media sites, talk shows, and broadcast news segments. Some information reaches individuals through passive means, such as when information about HPV vaccine is mentioned in conversation between persons, or when a link to an article about the vaccine is displayed on a social media website. Information can also be actively sought out through a variety of ways, such as from an

interpersonal source (e.g., asking family or friends about the vaccine or calling one's doctor) or from print or electronic channels (e.g., searching Google or CDC webpages for adolescent immunization information).

A variety of communication-related facilitators to adolescent immunization have been recognized, including school requirements, news coverage, family, friends, books, magazines or information from a library, Internet, TV shows/talk shows, and drug company advertisements (Dorell, Yankey, Kennedy, & Stokley, 2013). In this day and age where so many types of communication exist, it is important to understand where the public get their information and how the source and content of the information they access shapes their attitudes and decisions about vaccination.

Significance

To better understand these relationships, the current research project will explore attitudes towards HPV immunization and exposure to various sources of information as correlates of HPV vaccination intention and uptake. This research will contribute to the growing number of studies concerned with addressing the attitudes and beliefs that may contribute to parents' willingness towards immunizing their adolescents with HPV vaccine, and will contribute new information about the role of various information sources in a sample of parents in Richmond County, Georgia. Findings from this study may shed light on the most effective channels through which public health professionals can target parents of adolescents in order to increase HPV vaccine uptake.

Theoretical Frameworks

To understand how attitudes and beliefs of HPV immunization affect vaccine uptake, it is helpful to apply the Health Belief Model (HBM) and select constructs from the Integrated Behavioral Model (IBM). Primarily, HBM is a value-expectancy theory which states that a person will engage in a protective health-related behavior if that person feels that a negative health condition can be avoided, believes that by taking the recommended action he/she will avoid a negative health condition, and believes that he/she can successfully take the recommended action (Champion & Skinner, 2008). Due to the HBM's original inception as an explanation for the failure of a free tuberculosis-screening program, the model is still considered to be appropriate for use with one-time behaviors such as vaccinations (Noar & Zimmerman, 2005; Rosenstock, 1974). Much research has been conducted that relates the models' constructs of *perceived susceptibility, perceived severity, perceived barriers, perceived benefits, cues to action,* and *self-efficacy* in explaining or predicting adolescent vaccination behavior for both experimental and routinely recommended adolescent immunizations (Morin, Lemaitre, Farrands, Carrier, & Gagneur, 2012; Petty, Callahan, Chen, Edwards, & Dempsey, 2010; Shahrabani & Benzion, 2012).

Additionally, this research will draw on the constructs of perceived norms from the IBM. Perceived norms are comprised of two types: *descriptive norms*, normative beliefs about others' behavior; and *injunctive norms*, normative beliefs about others' expectations (Montano, 2008). In other words, descriptive norms describe the extent to which an individual believes the behavior is occurring among others; and injunctive norms describe an individual's appraisal of whether important others would approve of the behavior. Colleagues at the Emory Vaccine Center have demonstrated that social norms help explain greater dimensions of parental attitudes towards adolescent immunizations, specifically for

intentions to vaccinate (Painter et al., 2010). The application of HBM and IBM constructs in published studies about HPV vaccination will be detailed in Chapter II.

Research Questions

Understanding the sources of information that contribute to parental awareness and attitudes toward HPV vaccination is especially important now that the vaccine has been on the market for several years and uptake has been demonstrated to be suboptimal. This study seeks to answer the following research questions among a sample of parents of middle- and high-school students in Richmond County, Georgia:

1) How are parental attitudes associated with adolescent HPV vaccine uptake?
2) How are sources of information associated with adolescent HPV vaccine uptake?
3) Is the relationship between a greater number of HPV-related information source exposures and HPV vaccine uptake mediated by parental attitudes?

CHAPTER II. LITERATURE REVIEW

Purpose

A review of the literature was conducted to examine studies that have investigated the psychosocial correlates of parental attitudes towards HPV vaccine and adolescent uptake of HPV vaccine. It has been demonstrated that knowledge alone is not enough to increase acceptability of HPV vaccination (Dempsey, Zimet, Davis, & Koutsky, 2006); thus, other psychosocial attributes need to be considered. In particular, studies that employed constructs from HBM and the IBM were assessed to gain insight into the attitudes that surround adolescent HPV vaccination and the translation of those attitudes into intentions and actual uptake of HPV vaccine. Furthermore, health communication literature was reviewed to shed light on the ways in which parents and individuals may gain information about HPV vaccination.

HBM and IBM Construct Validity Applied to HPV Immunization Research

A few studies have been conducted that rigorously tested and validated measures based on constructs of the HBM to advance adolescent HPV vaccination research. The Carolina HPV Immunization Attitudes and Beliefs Scale (CHIAS) was the first instrument designed to measure parental attitudes and intentions towards HPV vaccination through a 16-item questionnaire that was guided by HBM constructs (McRee, Brewer, Reiter, Gottlieb, & Smith, 2010). Through strict psychometric and validity testing, four factors were demonstrated to be reliably associated with HPV vaccination intention: harms, effectiveness, barriers, and uncertainty. CHIAS was applied in a longitudinal analysis of North Carolina

parents and found that only perceived barriers reliably predicted actual HPV vaccination uptake by adolescent daughters over a one-year follow-up period (N. T. Brewer et al., 2011). CHIAS was modified and tested in a nationally representative sample of mothers of adolescent females recruited through the web-based KnowledgePanel system and found that results were largely consistent with the findings from the original CHIAS study (Gowda, 2012). The authors conducted an exploratory factor analysis and determined that three distinct factors were associated with HPV vaccine uptake in bivariate analyses, which they characterized as"harms/infectiveness," "barriers," and "social norms." The groundwork laid by these authors has honed in on the areas of the HBM and IBM that can best illuminate the attitudes that are held by parents concerning HPV vaccination.

HBM/IBM Related Barriers and Facilitators Towards HPV Vaccination

While a few studies utilized all or most of the constructs of the model as a guiding framework to investigate attitudes, beliefs, and acceptance of HPV vaccination among adolescents and/or their parents (N. T. Brewer et al., 2011; Reiter, Brewer, Gottlieb, McRee, & Smith, 2009), most studies have used just two or three constructs in combination with other variables to assess attitudes in predicting or explaining HPV vaccination intention or uptake (Baldwin, Bruce, & Tiro, 2012; Berenson & Rahman, 2012; Joseph et al., 2012; Litton, Desmond, Gilliland, Huh, & Franklin, 2011; Perkins et al., 2013; Rosenthal et al., 2008; Ziarnowski, Brewer, & Weber, 2009).

Early studies on the acceptability of the HPV vaccine identified higher perceived susceptibility and perceived benefits as being associated with parental acceptance of adolescent HPV vaccination (N.T. Brewer & Fazekas, 2007; Reiter et al., 2009; Rosenthal et

al., 2008; Ziarnowski et al., 2009). However, more recent studies have failed to demonstrate significant associations between perceived susceptibility and intentions, attitudes, or HPV vaccination series initiation (Baldwin et al., 2012; Berenson & Rahman, 2012; N. T. Brewer et al., 2011; Joseph et al., 2012; Litton et al., 2011).

Some studies have shown a weak association between perceived severity of HPV infection with positive parental attitudes towards vaccination, perhaps because there has been very little variability in the relatively small cross-sectional studies that measured this construct directly (Baldwin et al., 2012; N.T. Brewer & Fazekas, 2007; Litton et al., 2011). Yet, a recent qualitative study among parents of African-American and Latino adolescent males found that perceived susceptibility and perceived severity were high, and parents were generally accepting of HPV vaccination for their sons (Perkins et al., 2013). These findings suggest that attention to perceived susceptibility and perceived severity may be important as the adolescent male vaccination campaign gains more attention.

The HBM is most useful in understanding the likelihood that one will take a preventive health action in order to avoid a negative health outcome, which in this case is infection with HPV that has the potential to develop into cancer. However, in the context of adolescent HPV vaccination, the threat of HPV is being evaluated alongside the risks associated with the vaccine itself. In a recent national survey of parental attitudes of HPV vaccination, Darden et al. (2013) demonstrated that concern over safety of the vaccine is one of the greatest barriers to vaccination. The study, which used data from the 2008-2010 NIS-Teen survey, found that the proportion of parents who included “safety concerns/side effects” among the reasons that they did not vaccinate their child increased from 4.5% in 2008, to 7.7% in 2009, to 16.4% in 2010. Moreover, the proportion of parents who reported they did

not intend to have their child receive HPV vaccine increased from 39.8% in 2008 to 43.9% in 2010 (Darden et al., 2013).

Social norms have been shown to influence attitudes and behaviors surrounding HPV vaccination in various populations (Conroy et al., 2009; de Visser, Waites, Parikh, & Lawrie, 2011; Dillard, 2011). For parents, social norms may be related to normative beliefs about what their child, spouse, family members, or other parents believe about the vaccine. Findings from a national household survey reflect that parents whose child received HPV vaccine were more likely to report that family and friends endorsed vaccination and that the opinions of these significant others influenced their decision compared to parents who decided against vaccination (OR: 1.39, 95% CI: 1.24-1.56) (Allen et al., 2010). In the development of CHIAS, Gowda et al. (2012) determined that social norms adequately predicted HPV vaccine uptake among mothers in North Carolina specifically by asking participants to evaluate whether other parents in their community were getting their daughters the HPV vaccine (Gowda, 2012).

Other studies that were not explicitly guided by HBM or IBM frameworks found barriers and facilitators that reflected dimensions of these constructs. Barriers to HPV vaccine uptake or likelihood of vaccination among girls and young women have included cost, perception that the vaccine was unnecessary, and concerns regarding vaccine safety and side effects (Rambout, Tashkandi, Hopkins, & Tricco, 2013). A systematic review of worldwide English-language publications focused on immunization of adolescent girls found that intention to decline HPV vaccination was related to a preference for vaccinating at a later age to avoid risk compensation, concerns about vaccine safety, and low perceived risk of HPV infection (Hendry, Lewis, Clements, Damery, & Wilkinson, 2013). Being aware of

the benefits of vaccination, perceiving positive social norms surrounding vaccination, and receiving a recommendation from a health care provider have been shown to be facilitators of HPV vaccination (Rambout et al., 2013). Across the board with various populations and age groups, provider recommendation has emerged as one of the most well established correlates of HPV vaccine uptake or intention to vaccinate. A systematic review that included 53 studies published between 2001 and 2011 found that 17 studies included in their review showed evidence that a doctor recommendation increased the likelihood of HPV vaccination (Trim, Nagji, Elit, & Roy, 2012). Provider recommendation is related to several HBM and IBM constructs, as interaction with a health care provider likely enhances perceived benefits about vaccination, provides a cue to action, boosts self-efficacy in the steps needed to get their child vaccinated, and serves as an injunctive social norm for those that value health care practitioners.

Health Communication Surrounding HPV Vaccination

Recent research points to sources of information as an emerging point of consideration to fully assess parental attitudes and decisions about vaccinating their child. Vaccines, particularly those included in the routine childhood immunization schedule, are very much a part of the public discourse. Due to a long history of vaccination in this county, immunization schedules that coincide with regular check-ups in childhood, and the requirement of recommended immunizations for school entry, most parents are familiar with at least some information about vaccination or have gone through the experience of vaccinating their child. But HPV vaccine did not exist when today's parents were growing up, and is still relatively new to the recommended immunization schedule. Nevertheless, it is likely that after nearly eight years since the approval of the first HPV vaccine that many

parents have had at least some exposure to information about HPV vaccine. The likelihood of parental exposure to HPV vaccine information may be highly dependent on geographic and sociocultural factors as well as an individual's general information seeking behavior. For example, low awareness of HPV among Latino parents has been documented (Bair, Mays, Sturm, & Zimet, 2008; Scarinci, Garces-Palacio, & Partridge, 2007), and further study has found that Latino parents with lower levels of English-language proficiency were less likely to be exposed to materials related to cervical cancer and HPV vaccine than individuals with higher levels of English-language proficiency (Flores & Bencomo, 2009). Since adolescents tend to interface with the health care system on a relatively infrequent basis and mandates for school entry have not been widely implemented, parents of adolescents may or may not have been exposed to information about HPV vaccine on an institutional level.

Certainly, HPV vaccine has been in the news and has had the potential to reach parents. Media attention on a topic can shape public perception about the importance of the issue, and influence how people think about an issue. A content analysis of HPV and cervical cancer-related news reports that ran in major national newspapers and television news networks during several months before and after the approval of HPV4 (December 2005 – November 2006) found that stories about HPV vaccine were numerous during this time period, especially one month before and after approval (Kelly, Leader, Mittermaier, Hornik, & Cappella, 2009).

But the question is not just if information is out there, but if information is reaching parents and if they are affected by what they hear. Kelly et al. (2009) determined that HPV vaccine knowledge in the population grew as news coverage rapidly increased surrounding the time of vaccine approval, controlling for baseline knowledge (Kelly et al., 2009). Yet,

lack of information was documented in a systematic review as a barrier to HPV vaccine acceptance, with many study participants expressing dissatisfaction with the information available to them (Hendry et al., 2013). Ultimately, the various ways parents can learn about HPV vaccine may be related to vaccine uptake. A description of findings related to various types of information source is detailed below.

Health Care Provider

One of the most common sources of information about HPV vaccine reported by parents is a health care practitioner (N. T. Brewer et al., 2011; Caskey, Lindau, & Alexander, 2009; Cates et al., 2010; Grabiel et al., 2013). Data from the latest NIS-Teen survey show as much as 80% of parents reported that their adolescent's health care provider talked to them about HPV vaccine, and 71.3% stated that the provider recommended HPV vaccine (Dorell et al., 2013). It is well established that provider recommendation is one of the greatest predictors of HPV uptake and intention, and is associated with greater HPV vaccine knowledge and more positive attitudes towards HPV immunization (Dorell et al., 2013; Grabiel et al., 2013; Trim et al., 2012). Several studies have found that trust in a health care provider and a significant dialogue surrounding HPV vaccination are important drivers of these positive outcomes (Griffioen et al., 2012).

Family/Friends

Interpersonal communication such as discussing HPV vaccine among family members or friends may also be significant sources of HPV vaccine information for parents. A qualitative study of adolescents and their mothers found that beyond interactions with

clinicians, friends and family members were also important drivers of mothers' decisions to vaccinate their daughters (Griffioen et al., 2012). Almost all mothers in the study (N=28) reported discussing HPV vaccination with a family member, including their daughters' fathers, grandmothers, older daughters, and sisters. A 2009 study among low-income minority mothers aimed to investigate how social sources of information, defined as a family member or friend, and social discussion impacted perceived HPV vaccine effectiveness (Casillas et al., 2011). In their sample of women who were aware of the HPV vaccine and were the medical decision-makers for HPV-vaccine eligible girls, over 20% reported that they had heard about HPV vaccine from a social source. Women who heard about HPV vaccine from a social source were more likely to perceive the HPV vaccine as effective compared to those who did not report a social source of information (OR: 2.21, 95% CI: 1.02-4.75). Their model remained significant even when controlling for exposure to medical source and covariates affecting interaction with the health care system. The authors note that because a majority of women in this sample preferred to take the survey in another language and were foreign born, their findings might reflect that immigrant women are more reliant on social communication to obtain health information, a point that should be leveraged by public health practitioners.

Internet

There is a substantial body of evidence showing the Internet has become one of the most popular places for people to seek health-related information, including information regarding vaccines (Pew Research Center, 2009; Viswanath et al., 2006). Seeking information from online sources may be highly dependent on a number of sociocultural

factors, as previous research has found that African-Americans, Hispanics, and low-income individuals are significantly less likely to seek out health information online compared to their White and higher-income counterparts (Laz & Berenson, 2013; Miller, West, & Wasserman, 2007; Tu, 2008). Findings from a study by McRee et al. (2012) examining associations between parents' Internet information-seeking and their knowledge, attitudes, and beliefs about HPV vaccine within one year of vaccine approval suggest a positive influence of accessing information about HPV vaccine on the Internet. This study found that among parents of daughters in North Carolina, having heard of HPV through the Internet was associated with higher HPV knowledge, greater perceived susceptibility of HPV, and vaccination willingness, and with receiving a doctor's recommendation, as well as with lower perceived vaccine harms, uncertainty, and anticipated regret. Parents of sons who heard of HPV vaccine through the Internet, however, perceived greater barriers to vaccination than parents who learned about HPV vaccine for males through other sources, and past internet use was not associated with parents' willingness to have their son receive HPV vaccine (McRee et al., 2012). On a broader scale, an analysis of the National Cancer Institute's 2007 Health Information National Trends Survey (HINTS) demonstrated that non-internet users, compared with general Internet users, had significantly lower odds of being aware of the HPV vaccine and recognizing that cervical cancer is caused by HPV (Kontos, Emmons, Puleo, & Viswanath, 2012). The authors suggest that using the Internet as a communication channel may widen observed disparities in vaccine completion rates because internet use is known to be socially and racially patterned.

In addition, the content and tone of HPV vaccine information circulating on the Internet has been assessed. A study that used HBM constructs to structure a content analysis

of Internet searches on Google, Yahoo, Bing, and Ask.com found that in general, search results presented suboptimal or inaccurate information with regard to perceived benefits, barriers, susceptibility, severity, and self-efficacy (Madden, Nan, Briones, & Waks, 2012). A similar content analysis conducted among Youtube videos that addressed HPV vaccination discovered that the majority of videos were negative in tone but presented mixed information related to HBM constructs (Briones, Nan, Madden, & Waks, 2012). In an earlier study analyzing content on Myspace blogs, a social networking site that was popular prior to and around the time of the first HPV vaccine approval, 52% of blogs reviewed were classified as positive, 43% as negative, and 6% as ambivalent towards HPV vaccination (Keelan, Pavri, Balakrishnan, & Wilson, 2010). Most positive blogs emphasized a combination of perceived susceptibility, perceived severity, and perceived benefits; but safety and adverse events were rarely mentioned. Negative blogs were highly focused on the issue of safety and personal choice, but minimized somewhat the perceived seriousness of HPV infection and perceived benefits of vaccination. Blogs that were positive in tone tended to reference credible authorities such as CDC, while negative blogs often cited anti-vaccination groups like the National Vaccine Information Center. Adjusted for population size, California, New York, Texas, and Florida had the highest amount of HPV vaccine blogging activity (Keelan et al., 2010).

Print Media

Although the Internet and mobile technologies are gaining popularity as points of access for news, print sources are still extremely relevant. Casciotti et al. (2014) refer to print news reporting as the original source for much of what is later reported in other media, thus

providing a valid "snapshot" of the news environment. The authors conducted a structured analysis of U.S. news media articles published between 2005-2009 that examined adolescent health behaviors related to HPV vaccination (Casciotti, Smith, Tsui, & Klassen, 2014). Their analysis found that nearly half of the 49 articles sampled were positive in tone, but conflict (i.e., presentation of competing viewpoints, tension, or lack of consensus) was present in a majority of articles. About half of the articles were prompted by research studies, and other articles were published preceding or following action by government or regulatory bodies. Although this study only covers newspaper articles published up to three years after FDA approval of Garadsil, the findings demonstrate that media messages were generally supportive of HPV vaccination, presenting evidence of the benefits for males and females, and argued that the vaccine should not be associated with promiscuity. This team of researchers also conducted a structured text analysis of newspaper coverage during the same time period specifically to examine discussion of school-based HPV vaccine mandates (Casciotti, Smith, Andon, et al., 2014). The authors found that newspaper coverage surrounding HPV vaccine mandates often left out context about cervical cancer or screening, and reflected skepticism and concerns over autonomy and distrust of government activities. Most articles were positive, or mixed in tone, and about 40% of articles were prompted by legislative activity.

Advertisements from drug companies

Drug companies may advertise their products through a variety of media, and studies have demonstrated that exposure to drug advertisements about HPV vaccine has been widespread (Hughes et al., 2009). The maker of the first marketed HPV vaccine, Merck,

sponsored a direct-to-consumer advertising campaign called “One Less,” to promote the roll-out of the vaccine, which is often recalled by parents and adolescents in research studies (Allen et al., 2012; Katz et al., 2009; Leader et al., 2011). On a national level, drug advertisements have been recognized as an influential factor in parents’ decision to get their child immunized with HPV vaccine (Dorell et al., 2013). Overall trust in pharmaceutical companies is likely a factor in how receptive an individual is to HPV vaccine advertisements. A nationally representative survey conducted from 2007-2008 found that parents who had vaccinated their daughter or intended to do so reported higher levels of trust in pharmaceutical companies that produce the vaccine compared to parents who opposed HPV vaccination (Allen et al., 2010). In-depth interviews with mothers revealed that exposure to media and marketing about HPV vaccination played a crucial role in their decision to vaccinate their daughters by raising awareness about the vaccine, providing facts about the vaccine and its benefits, prompting discussions with their daughters, and encouraging them to seek more information (Griffioen et al., 2012). One mother explained, “I had seen the commercials, and I did have questions that weren’t answered from the media…so I asked my doctor and I got online” (Griffioen et al., 2012). Being exposed to a drug advertisement may be an important cue to action in getting parents to have dialogue with their child’s health care provider. Encouraging interaction between parents and providers could be a strategy to facilitate the opportunity for a provider recommendation, a strong correlate of HPV vaccine uptake.

Broadcast Media (Television and Radio)

Another source that parents have reported hearing about HPV vaccine has been broadcast media. These platforms may disseminate information about HPV vaccine through news stories, talk shows, debates, and more. It is likely that many studies measuring exposure to broadcast media sources like television and radio did not distinguish between advertisements and other coverage. A 2007 study found that more parents had heard about HPV vaccine from a broadcast media source compared to print sources, a health care provider, or the Internet (Hughes et al., 2009). In this study, a higher proportion of African-American parents reported hearing about HPV vaccine through a broadcast source compared to white parents. Another study quoted a Latino female focus group participant reflecting on exposure to television media: "I know about HPV and the vaccine because they advertise the HPV vaccine a thousand times on Univision and Telemundo [Spanish-language television networks]." Women in this study reported that television and radio advertisements were their primary source of information about HPV and the vaccine (Allen et al., 2012). While broadcast sources have been described in the literature descriptively, there is scant evidence that exposure to these sources demonstrate a significant association with HPV vaccine uptake or intention.

Objective of the Current Study

In light of the previous work that has identified important drivers of adolescent HPV vaccination, this study aims to assess how attitudes and sources of information influenced uptake and intention of HPV immunization in Richmond County, Georgia.

CHAPTER III. METHODS

Overview

As a secondary data analysis, the participants for this study consist of parents of middle- and high-school students in eastern Georgia who participated in the "Enhancing Adolescent Immunization through Parent and Teacher Interventions" study implemented by researchers from Rollins School of Public Health and the Emory Vaccine Center. The project was funded by CDC cooperative agreement 5UO1IP000413 and received approval from the Emory University Institutional Review Board. The original study was a randomized controlled trial designed to provide education about all four of the currently recommended adolescent vaccinations (Tdap, MCV4, HPV, and influenza vaccine) to adolescents and their parents, as well as increase adolescent vaccination rates for all four vaccines. This thesis utilizes data from a cross-sectional survey administered to parents from April through July 2013, with a focus on a subset of questions regarding HPV vaccination. All data were void of any personally identifiable information.

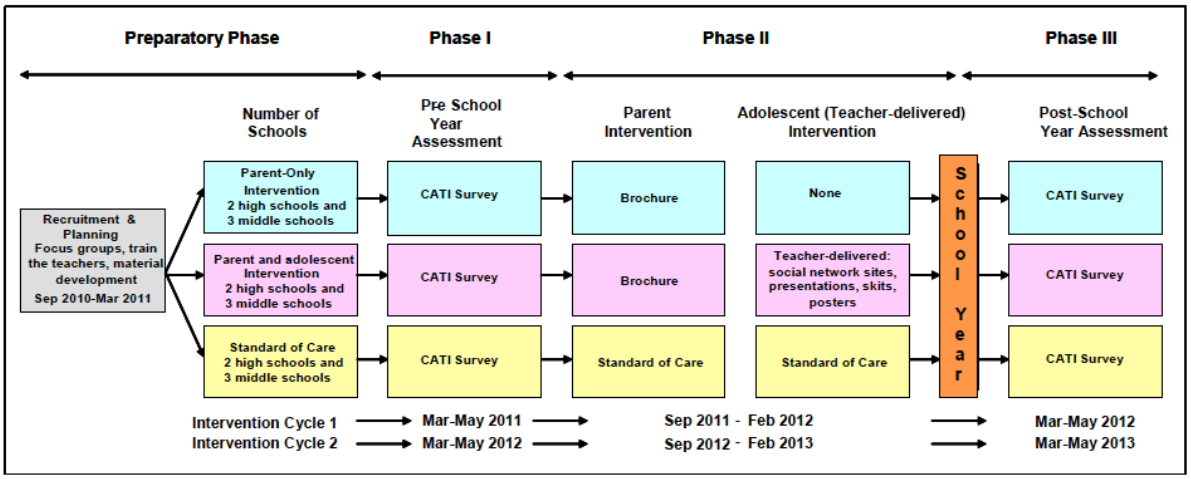
The parent trial consisted of two intervention arms (parent-only intervention vs. parent & adolescent intervention) and one control arm. Eleven schools in Richmond County, Georgia were selected to participate in the study. After stratifying by school type (middle- or high-school), two high-schools and two middle-schools were randomly assigned to each arm (with the exception of the control group; implemented in two middle-schools and one high-school). An overview of the original research design is shown in **Figure 1**.

Participants

The participants for this cross-sectional study were parents, guardians, or caregivers

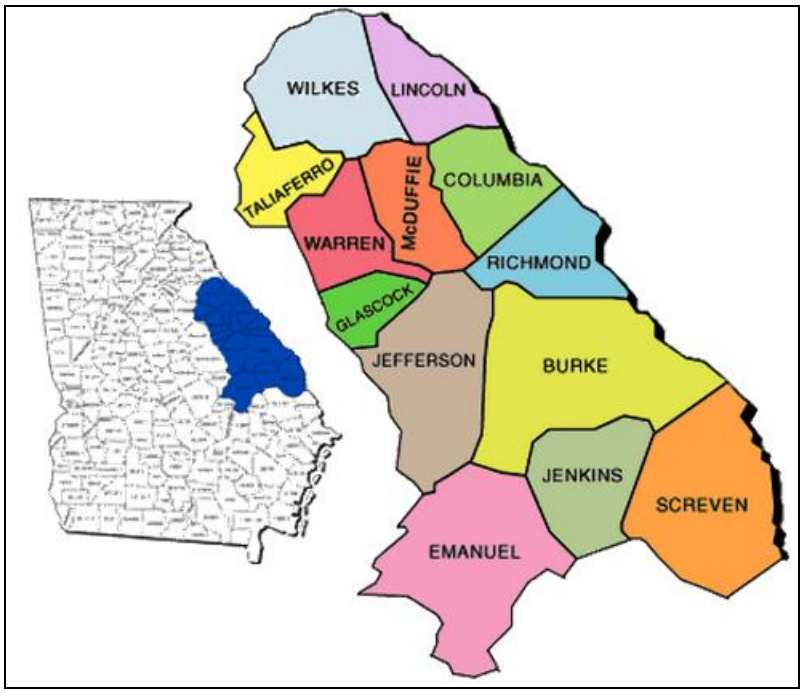
(hereafter referred to as "parents") who responded on behalf of students who were involved in the randomized controlled trial that was conducted in Richmond County, Georgia, located in the northeastern part of the state (see **Figure 2**, Map of East Central Health District, Georgia). Richmond County is the largest county within the East Central Health District, and has a relatively diverse population. Within the county, there are a mix of rural and urban schools, and a substantial low-income and minority population. Demographic characteristics of the county gathered from the 2010 census are shown in **Table 1**.

Figure 1. Study Design



Note: Number of schools was later amended to 2 middle schools and 2 high schools in each arm; Control arm implemented in 2 middle schools and 1 high school

Figure 2. Map of East Central Health District, Georgia



Source: Georgia Dept. of Public Health

Table 1. Sociodemographic Characteristics of Richmond County, Georgia

	Richmond County	United States
Total Population	194,398	293,656,842
Total Family Households	49,509	71,787,347
% African American	52.6	12.0
% White	41.4	67.3
% Asian	1.6	4.2
% American Indian	0.3	0.6
% Other	0.1	0.3
% Hispanic (any race)	2.5	14.2
% Population Urban	92.2	79.0
% Population Rural	7.8	21.0
% Children under 18 living with one parent	17.8	23.4
% Children 6-17 in families both parents or single parent works	66.0	67.4
% Population determined to be living in poverty	19.6	12.4
% Children 6-11 determined to be living in poverty	29.6	16.9
% Children 12-17 determined to be living in poverty	23.4	14.8

*Source: U. S. Census Bureau and the Georgia DHR Division of Public Health OASIS; Compiled by the East Central Health District as County Profiles. Accessed 4/16/2010 from: http://www.ecphd.com/common/content.asp?PAGE=308

Eligibility Criteria

To be eligible for the study, adolescents had to be enrolled at a target school, families had to reside in Richmond County, and parents were required to provide written informed consent to the pre- and post-school year computer-assisted telephone interview (CATI) surveys.

Sample Size

The intervention trial planned to include 1,290 parents: in order to detect a 10% change in vaccination rates, a minimum of 430 participants were required in each arm to detect this change with 95% confidence and 80% power. For the baseline and follow-up surveys, potential participants were identified through a simple random sample of parents at each of the participating schools. Survey items pertinent to the research questions of this thesis were added in February 2013, thus only the third year and final year of data collection was assessed. Since the current analysis is not designed to detect differences by study arm, the sample was treated as a cross-section. Out of a total of 4,876 parents invited to participate in this wave of data collection, 129 parents completed a follow-up CATI survey, yielding a 7.4% response rate.

Procedures for the Parent Study

This is a secondary data analysis of an intervention that collected follow-up information about students in order to assess changes in uptake of adolescent vaccines. The parent study was a multi-component three-arm randomized controlled trial, which included two intervention arms and a control group. The intervention arms were 1) a parent-only

intervention consisting of an educational brochure about adolescent immunizations guided by theoretical constructs, and 2) a parent and adolescent intervention, which consisted of a teacher-delivered presentation, prescribed hands-on activities, problem-based learning exercises, and social networking activities. The goal for the parent study was to assess the efficacy of two interventions, relative to the control condition, and to each other. All eligible parents completed a baseline survey before the intervention was delivered at target schools in the fall of 2012, and all parents were contacted to take a follow-up survey at the end of each year of study implementation. Parents were mailed postcards informing them of the survey and providing them instructions to participate. A reminder postcard was mailed to parents who had not yet completed the survey in May 2013.

The third and final year of follow-up surveys began in April 2013 and continued through July 2013. Each survey took approximately 20 minutes to administer and parents received a $20 gift card as compensation for completing the survey. Experienced members of the research staff who were trained in collecting data via telephone conducted the surveys. Response errors were minimized by the use of pre-determined response options. The interviewer recorded responses to open-ended questions verbatim.

Measures

Parents were interviewed via telephone about their middle- or high-school child. The survey assessed self-reported sociodemographic characteristics, past medical history, overall attitudes and beliefs about immunizations, and specific psychosocial attributes and behavioral outcomes of influenza, Tdap, MCV4, and HPV immunization. Sociodemographic items included survey respondents' relationship to the child, the child's gender, race, birth

date, grade in school, type of health insurance coverage, and past medical history. Each survey section followed a similar structure, with items about attitudes and beliefs towards the vaccine preceding inquiries about receipt of the vaccine. The remaining description of the methods of this study pertains to the HPV measures only, which were asked following items regarding influenza, Tdap and MCV4. The domains covered by the survey questions used for this analysis were: a) general attitudes about immunization, b) attitudes and beliefs about HPV vaccine, c) sources of information and information seeking, d) physician recommendation, d) HPV vaccination history or intentions, and e) facilitators or barriers associated with HPV vaccine receipt or non-receipt. Survey items were largely derived from a pilot study of the intervention, which focused on influenza only. Measures within each domain are described below.

Sociodemographic Characteristics

Survey respondents were asked to report their relationship to the child and the child's gender, race, and insurance status according to pre-determined categorical responses. The child's month and year of birth, grade in school, and medical history (asthma, diabetes, sickle cell anemia disease, chronic lung disease, or other) were asked. Respondents were also asked, "Do you believe your child's routine vaccinations are up to date?"

General attitudes towards immunization

Constructs from HBM and IBM were applied to measure general attitudes and beliefs about immunization. These items were asked at the beginning of the survey following sociodemographic characteristics. Parents were asked about 1) belief that pre-teens and teens

should be immunized against serious disease, 2) belief that vaccines are proven safe prior to approval, 3) perception that their child's immune system can be weakened by too many immunizations, 4) perception that the vaccine might make their child sick, and 5) acceptability of vaccination for school entry requirement. All attitude items were structured as dichotomous variables ("True"/"False" or "Yes"/"No").

Attitudes towards HPV immunization

Constructs from the HBM and IBM were applied to measure attitudes and beliefs about HPV vaccination. Parents were asked about 1) perception of their adolescents' susceptibility to HPV infection, 2) perception of how serious they think it would be if their adolescent acquired HPV, 3) perceived benefits of having their adolescent child vaccinated against HPV, and 4) dimensions of social norms regarding HPV vaccination. One item aimed to assess injunctive social norms and one question assessed descriptive social norms. All items had dichotomous "True/False" response options. Application of theoretical constructs and wording of survey items is presented in **Appendix A**.

Sources of information and information seeking

Several questions were asked to examine exposure and relative value of information sources as correlates of HPV vaccine uptake. Parents were asked to indicate whether or not they had heard of HPV vaccine from each of the following eight sources: doctor/medical professional, family or friends, drug advertisement, internet (non-drug advertisement, such as a webpage or blog), TV (non-drug advertisement, such as the news), radio (non-drug advertisement), newspaper/magazine article, or other. Responses to the "other" category

were recorded verbatim. Parents were asked to select all responses that applied; thus, it was possible to report exposure to up to eight sources. The relative value of these information sources was assessed through the question, "Of these sources, which two are the most influential to you?" One point was assigned to the category that the participant listed among their top two most influential sources. Information seeking behavior was elicited through two items. Participants were asked, "Did hearing about the HPV vaccine from any of the above sources besides a health care provider prompt you to talk to child's doctor about HPV vaccination?" with dichotomous response options. Value of information source leading to information seeking was assessed with a follow-up question yielding a categorical outcome: "Which source [of the above categories] had the greatest impact on deciding to talk to your child's doctor about the HPV vaccine?" Participants were also asked about their perception of media sources through the question, "Has what you have heard about HPV in the media, say in the newspaper or on TV, been mostly positive, mostly negative, or would you say it's been neutral?" This item was based on a survey administered to parents of adolescent girls in North Carolina (Hughes et al., 2009). The researchers involved in that study chose to dichotomize the responses into "positive," vs. "neutral/negative," but this analysis maintained all three levels to preserve the descriptive nature of the question.

Other Correlates of Interest

Parents were also asked, "If HPV vaccine was available at your child's school would you allow them to be vaccinated?" Additionally, participants were asked whether or not a doctor recommended that their child receive the HPV vaccine, with possible response options

including, “Yes,” “No” or “Unknown.”

HPV Vaccine Uptake or Intention to Vaccinate

The main outcome of interest was HPV vaccine uptake. Vaccination history was assessed with regard to receiving at least one dose of HPV vaccine, or receiving all three doses. Receipt of at least one dose of HPV vaccine was selected as the main uptake variable, as this outcome may be easier for respondents to recall accurately and has been used in numerous other studies as an appropriate measure. If participants responded that their child had not received at least one dose of the vaccine, intention to receive HPV vaccine was assessed through the question, “Do you ever plan to have your child receive the HPV vaccine?” with dichotomous answer choices (“Yes”/“No”).

Barriers to HPV Vaccine Uptake

Eleven items assessed barriers to HPV vaccine uptake among parents who stated that they did not plan to have their child vaccinated against HPV. Sample items included statements such as, “My child did not need it,” “The vaccine costs too much,” and “I was concerned it would make my child sick.” Participants were asked to respond “Yes,” “No,” or “Unknown” to each item.

Facilitators of HPV Vaccine Uptake

Four items assessed facilitators to HPV vaccine uptake among parents who stated that their child had received at least one dose of HPV vaccine or planned to receive HPV vaccine. Sample items included, “It was recommended by a friend/family member,” and “It was

recommended by the health department." Participants were asked to respond "Yes," "No," or "Unknown" to each item.

Data Analysis

Prior to conducting the analyses, data were checked and cleaned for accuracy. A few new continuous variables were calculated by summing responses to several items. Adolescent age was calculated by subtracting the survey date from the student's birth date, and rounded down to the nearest integer. A general attitude score was created from five individual items in which each "true" response contributed one point towards the overall attitude score. Four items were reverse coded in order to ensure that a higher score reflected more positive attitudes. Possible total scores ranged from 0 to 5, with higher scores reflecting more positive attitudes towards immunization. Similarly, an HPV vaccine attitude score was computed for the six HPV vaccine attitude items. Each "true" item contributed one point to the overall HPV vaccine attitude score. Possible total scores range from 0-6, with higher scores indicating more positive attitudes towards HPV vaccination. Additionally, a total information exposure score was created to reflect the total number of sources that participants had heard about HPV vaccine. A "yes" response to any source, including "other," contributed one point to the overall number of sources (possible range: 0-8, which a higher score reflecting a greater number of information sources). Write-in responses for "other" sources were examined and determined to be distinct from the other response options, and thus were included as a separate category (n=16).

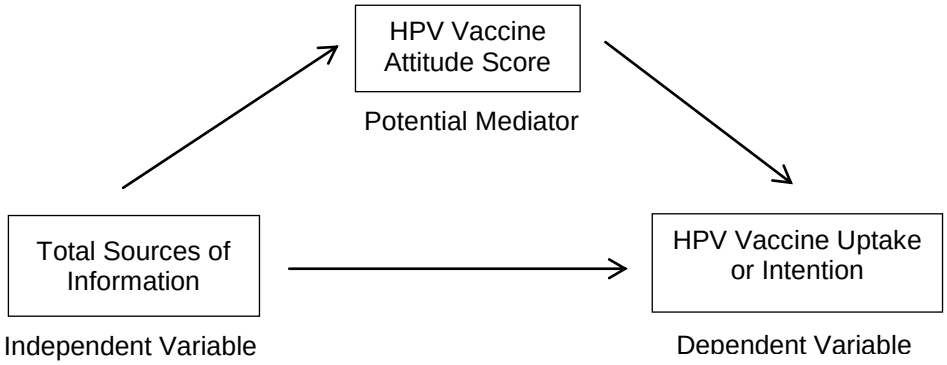
Descriptive statistics were conducted on sociodemographic characteristics, general attitudes towards immunization, attitudes towards HPV immunization, information sources,

and outcome measures. Frequencies were produced, or means and standard deviations when appropriate. Univariate analyses were performed on the overall sample, and were also broken down by study arm, and by gender. For categorical variables, chi-square tests were conducted to determine whether there were differences between the three study arms, or between females and males. The chi-square test assumes the expected value for each cell is ≥5, thus, Fisher's exact test was used when expected cell counts were low (no test statistic associated with this test). A One-Way Analysis of Variance (ANOVA) was used to test for differences in continuous variables between the three study arms, and a two-sample t-test was used to test for differences in continuous measures between males and females.

For the first two study hypotheses, bivariate analyses were conducted to assess associations between independent variables and main outcome variables. Bivariate associations were tested separately for receipt of at least one dose of HPV vaccine and intention to receive HPV vaccine. Tests were performed for the overall sample and stratified by gender, as significant differences in the some independent variables and the main outcome was detected at the univariate level. Associations with the dichotomous outcome variables were examined against the individual constructs within each domain (i.e., each attitude item, or each information source), but also according to the overall computed scores. Chi-square tests (or Fisher's exact test where expected cell count was low) were performed on categorical independent variables to determine if responses differed according to receipt vs. non-receipt of HPV vaccine, or intent vs. non-intent to receive HPV vaccine. Differences in mean scores were evaluated using two-sample t-tests. When the F-statistic was significant, unequal variances was assumed.

A mediation analysis was performed to test the third hypothesis, that parental attitudes explain the association between information sources and HPV vaccine uptake (see **Figure 3**, Proposed Mediation Model). Mediation analysis requires continuous independent variables; thus, HPV vaccine attitude score and total number of information sources were utilized. A series of simple regressions were conducted to determine if mediation was possible. First, a regression was conducted to determine whether the independent variable, total information source exposures, was associated the outcome of HPV vaccine uptake; and that the potential mediator, HPV vaccine attitude score, was associated with the outcome. Next, a correlation was run to determine whether the independent variable and potential mediator were associated. Then, a multiple logistic regression was performed that included both the independent variable and potential mediator in the model. The p-value and Beta values in the final model were compared to the results of the original regression to determine if there were any changes in the association between information source and HPV vaccine uptake when controlling for attitude. All analyses were performed using SAS 9.3 statistical software (SAS Institute, Cary, NC), and evaluated at the $p=0.05$ significance level.

Figure 3. Proposed Mediation Model



The proposed mediation model tests whether HPV vaccine attitude score explains, in part, the relationship between total sources of information and receipt of at least one dose of HPV vaccine, or intention to receive HPV vaccine.

CHAPTER IV. RESULTS

Descriptive Statistics

The survey inquired about 129 middle- and high-school students in Richmond County, Georgia. Sociodemographic characteristics of the sample are displayed in **Table 2.** Responses were most commonly provided by the mother of the student. Adolescents were enrolled at 11 different schools in the county, with representation of students in grades 6 through 12. A large majority of the students inquired about in the survey were African-American (88.4%), and there were nearly an equal number of females (n=64) and males (n=65). The mean age of adolescents was 14.25 years (±1.9). A majority of parents reported that their child was insured through Medicaid (73.6%), as compared to private insurance (21.7%) or no insurance (3.9%). As expected with the randomized design of the parent study, there were no differences in sociodemographic characteristics according to study arm.

General attitudes towards immunization were assessed with five items. In general, there was high favorability towards immunizations among parents, as a majority of respondents answered in the favorable direction for all five items **(Table 3)**. The mean overall attitude score was 3.38 (±1.28). About 80% of parents agreed that immunizations are always proven safe before they are approved before use, and disagreed that their child's immune system could be weakened by too many immunizations. However, 64% of parents reported that their child could get sick from the vaccine itself. There was a significance difference in response to the statement, "Pre-teens and teens should only be immunized against serious disease," according to study arm (p=0.043). Approximately 30% of parents in each of the intervention arms answered "true" to this item, compared to 10% in the control

arm. Only 1 item demonstrated a significant difference by gender: a higher proportion of parents of girls agreed with the statement, "My child's immune system could be weakened by too many immunizations" compared to parents of boys (29.7% vs. 13.8%, p=0.029). There was not a statistically significant difference in the total attitude score by study arm or by gender.

Attitudes towards HPV immunization were assessed through six theoretically derived survey items. A majority of respondents answered in the favorable direction for perceived severity (1 item) and perceived benefits (2 items); however, perceived susceptibility (1 item) was low and social norms (2 items) demonstrated an almost equal split **(Table 4).** . The mean HPV vaccine attitude score was 4.15 (±1.42). Perceived severity (91.3%) and perceived benefits (>80% for each item) were particularly high in the overall sample. However, a higher proportion of parents of girls agreed that "Children should be vaccinated against HPV," compared to parents of boys (96.8% vs. 79.4, p=0.002). Perceived susceptibility among parents was low, as 62% did not believe their child was very likely to get HPV. There was a statistically significant difference between study groups in response to the item evaluating descriptive norms: "Most parents I know take their child for HPV vaccine" (p=0.033). There was not a statistically significant difference in the total HPV vaccine attitude score by study arm or by gender.

Exposures to sources of information about HPV vaccine are shown in **Table 5a.** Overall, parents in the sample had heard about the HPV vaccine from an average of 4.2 sources (±2.36). Commonly reported sources of hearing about HPV vaccine were doctor or medical professional (79.8%); TV, non-drug advertisement such as the news (74.4%); advertisement from a drug company (67.4%); followed by newspaper or magazine article,

non-drug advertisement (51.9%); family or friends (47.3%); radio, non-drug advertisement (45.7%); internet, non-drug advertisement such as webpage or blog (42.64%); and other (12.4%). "Other" sources reported by parents included: work, church, health department, pharmacy/drugstore, college campus, neighborhood watch group, pamphlets, insurance flyer, and school. A significant difference was observed between study arms for exposure to HPV information from a doctor or medical professional and advertisement from a drug company, although it is unlikely that the intervention is related to reports of information exposure. The only source which demonstrated a significant difference in exposure by gender was doctor or medical professional. A significantly higher proportion of parents of girls heard about HPV vaccine from a doctor/medical professional compared to parents of boys (89.1% vs. 70.8%, p=0.0096).

As shown in **Table 5b**, a large majority of the sample ranked a doctor/medical professional among their top 2 most influential sources of information (80.2%); other influential sources were TV (29.7%) and family/friends (22.5%). While there was a high frequency of ranking doctor/medical professional among one's top 2 most influential sources, a significantly higher proportion of parents of girls selected this choice, compared to parents of boys (87.9% vs. 71.7%, p=0.032). Although advertisements from a drug company were identified as the 3rd most common source of exposure to information about HPV vaccine, only 6.3% of the overall sample ranked this source among their top 2 most influential sources. Approximately 14% of selected "other," as one of their top 2 most influential sources, which represents a higher frequency than advertisements, internet, radio, or newspaper/magazine articles. "Other" responses included: their own knowledge, work, drugstore, health department, and neighborhood watch. A large proportion reported that

hearing about HPV vaccine from one of the sources besides a doctor/medical professional prompted them to talk to their child's doctor (62.8%). The source that was reported most frequently as having the greatest impact on deciding to talk to their child's doctor about HPV vaccine was TV (43.4%) followed by family/friends (31.6%). A great majority reported that what they have heard about HPV vaccine in the media has been either "mostly positive" (47.5%) or "neutral," (50%), compared to "mostly negative" (2.5%). There were no differences in responses between parents of girls and boys regarding the influential sources, motivation to talk to one's doctor, or media portrayal.

Items that comprised the main outcome measures included receipt of a doctor recommendation, receipt of at least one dose of HPV vaccine, receipt of all three doses of HPV vaccine, and intention to receive HPV vaccine (**Tables 6-7**). Nearly two-thirds of the overall sample reported that a doctor recommended their child receive HPV vaccine, although this finding differed significantly between girls and boys (81.3% vs. 45.3%, $p<0.0001$). Receipt of at least one dose of HPV vaccine was higher than the average rates in Georgia and in the U.S. among girls (71.9%) and boys (34.9%). The proportion who received all 3 doses was also higher than proportions in the general population (54.4% for girls, 27.3% for boys). Of the 22 boys who received at least one dose of HPV vaccine, 6 (27.3%) had received all three shots. Among those who had not received at least one dose of HPV vaccine, 75.9% of parents reported that they planned to have their child receive the HPV vaccine. Among parents of children who had not initiated the series, there was a significant difference in intention to vaccinate with HPV vaccine between girls and boys (94.1% vs. 68.3%, $p=0.046$). There was no difference in receipt of HPV vaccine (either one dose or all three doses) by study arm, but there was a significant difference in intention to

receive HPV vaccine (53.3% in the control group; 77.3% in the parent-only intervention; and 90.5% in the parent & adolescent intervention, p=0.036).

Parents who reported that their child received at least one dose of HPV vaccine or intended to receive HPV vaccine were asked about several items that facilitated their decision **(Table 8)**. By far the most important facilitator identified by parents as to why they decided to get their child vaccinated or intended to get vaccinated was being recommended by the family doctor (90.3%). Nearly 40% of parents also stated that hearing about HPV vaccine in the news, being recommended by a friend/family member, and being recommended by the health department also influenced their decision. There were also several common "other" reasons that parents listed as facilitators, including a personal experience of cervical cancer (family history or knowing someone affected), desire to protect their child or prevent cervical cancer, and a belief that it is important. Facilitators were similar between study groups and between females and males, except for health department recommendation. There was a statistically significant difference in recommendation from the health department by study arm (18.7% in the control group; 46% in the parent intervention; and 45.4% in the parent and adolescent intervention, p=0.029). Additionally, a significantly higher proportion of parents of boys reported that a recommendation from the health department influenced their decision compared to parents of girls (52.3% vs. 25.8%, p=0.0031). Nearly two-thirds of parents said they would allow their child to be vaccinated if HPV vaccine was available at their child's school (no differences by gender).

Parents who did not vaccinate their child with at least one dose of HPV vaccine and reported that they did not intend to have their child receive HPV vaccine were asked whether certain items influenced their decision. A total of 15 parents answered these items which are

presented in **Table 9.** Concerns for side effects, beliefs that their child did not need the vaccine, and reports that their doctor did not recommend the vaccine for their child were common barriers. No parents identified difficulty finding time or an available appointment as a barrier. Cost, fear of needles, concern that their child was too young, and worry of increased sexual activity were reported very infrequently by participants.

Bivariate Analyses

Several bivariate associations were examined with regards to the two main outcome variables of interest: receipt of at least one dose of HPV vaccine or intention to receive HPV vaccine. Prior to testing the associations outlined in the study hypotheses, associations were tested between and among sociodemographic variables and covariates. There were no major differences according to any sociodemographic characteristic for the following covariates: overall vaccination attitudes, HPV vaccination attitudes, information source exposure, being prompted to talk to one's doctor, receipt of a doctor recommendation, receiving at least one dose of the vaccine, or intending to receive the vaccine. Within the domain of general immunization attitudes, the item, "My child could get sick from the vaccine itself" showed a significant association with race in the overall sample. A significantly higher proportion of African-Americans felt their child could get sick from the vaccine itself compared to all other races ($p=0.0096$). Gender differences were expected, thus, all associations between independent and dependent variables were stratified according to gender.

The main findings from the bivariate analyses demonstrate that receipt of at least one dose of HPV vaccine was associated with each of the following variables: physician recommendation, higher HPV vaccine attitude scores (reflecting more positive attitudes), and

greater number of sources of exposure to HPV vaccine information. Intention to receive HPV vaccine was significantly associated with higher HPV vaccine attitude scores only. Doctor recommendation was associated with receipt of at least dose of HPV vaccine within the overall sample and for both males and females (all significant at the p<0.0001 level, **Table 10a**). The relationship between provider recommendation and intention to receive HPV vaccine approached significance in the overall sample (p=0.068, **Table 10b**). Detailed results for each main research question are described below.

RQ 1. How are parental attitudes associated with adolescent HPV vaccine uptake?

Chi-square tests were performed to test for differences in responses to individual HPV vaccine attitude items between those who received at least one dose of HPV vaccine, and those who did not. Among those who did not receive at least one dose of HPV vaccine, chi-square tests were performed to test for differences in responses to HPV vaccine attitude items between those who intended to have their child receive HPV vaccine, and those who did not.

Overall, perceived susceptibility, perceived benefits, and injunctive social norms exhibited statistically significant associations with receipt of at least one dose of HPV vaccine (**Table 11a)**. Although perceived severity was reported in greater than 90% of the sample at the univariate level, this construct was not associated with uptake at the bivariate level. Almost all parents reported a "true" response to both perceived benefits items; thus, no differences were observed according to vaccination status. The item measuring descriptive social norms ("Most parents I know take their child for HPV vaccine") was not associated with HPV vaccine uptake overall or for either gender.

With regard to intention to receive HPV vaccine, all constructs were significantly associated with the outcome in the overall sample, with the exception of perceived severity (**Table 11b)**. Almost all parents reported that HPV infection can cause serious disease. Because a large proportion of the females inquired about in the study had already been vaccinated with at least one dose of HPV, the sample size for intentions was reduced (n=17); therefore, meaningful differences in attitudes could not be determined. Among males, there were sufficient data to conduct Fisher's exact test, which revealed significant differences in responses to perceived susceptibility, perceived benefits, and injunctive norms.

Results from two-sample t-tests demonstrate a statistically significant association between HPV vaccine attitude and vaccine uptake and intention. Mean HPV vaccine attitude score was higher among those who received at least one dose of HPV vaccine compared to those who did not receive the vaccine (4.57 vs. 3.71, p=0.001), as was the mean score among those who intended to have their child receive HPV vaccine compared to those who did not intend to have their child vaccinated (4.14 vs. 2.09, p=0.0001). This significant bivariate association is observed among the overall sample and among males, but not for females.

RQ 2. How are information sources associated with adolescent HPV vaccine uptake?

Bivariate analyses were performed to test for differences in exposure to various information sources between those who received at least one dose of HPV vaccine, and those who did not, as well as among those who intended to receive HPV vaccine and those who did not. Results from chi-square tests for individual sources and two-sample t-tests for the total number of sources are presented in **Tables 12a-b**.

Hearing about HPV vaccine from a doctor or medical professional was significantly associated with receipt of at least one dose of HPV vaccine among the overall sample ($p<0.0001$) and among males ($p=0.001$). A high proportion of parents of females reported hearing about HPV vaccine from a doctor or medical professional, regardless of vaccine uptake. Hearing about HPV vaccine from TV and radio were also significantly associated with receipt of at least one dose of HPV vaccine ($p=0.012$ and $p=0.034$, respectively). Comparison of the mean number of information source exposures in the overall sample demonstrated that those who received at least one dose of HPV vaccine had a greater number of exposures to sources of information compared to those who did not receive HPV vaccine (4.66 vs. 3.73, $p=0.026$). This association was also significant for males ($p=0.048$).

There was a significant relationship between hearing about HPV vaccine from a doctor or medical professional and intending to receive HPV vaccine in the overall sample ($p=0.002$) and among males ($p=0.004$). Having a conversation about HPV vaccine with family/friends was the only other source of information to exhibit a significant association with intention to receive HPV vaccine(overall sample, $p=0.0007$; males, $p=0.001$). Those who intended to receive the vaccine did not report a significantly higher number of information sources exposures compared to non-intenders ($p=0.061$).

In addition to exposure to various information sources, the relative value of each information source was examined against HPV vaccine uptake and intentions (**Tables 12c-d**). Ranking a doctor or medical professional, advertisement from a drug company, and radio within their top two most influential sources of information were significantly associated with receipt of at least one dose of HPV vaccine. Television was the only top ranked source to exhibit a significant association with intention to receive HPV vaccine ($p=0.015$). Being

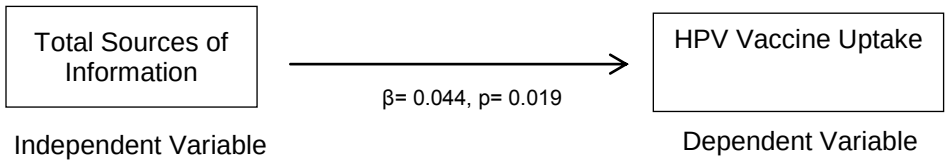
prompted to talk to a doctor after hearing about HPV vaccine from the mentioned information sources was not significantly associated with HPV vaccine uptake, but was associated with intention. A higher proportion of parents who intended to have their child receive HPV vaccine reported that they were prompted to talk to their child's doctor after hearing about HPV vaccine from one of the mentioned sources compared to parents who did not intend to vaccinate their child (p=0.05).

RQ 3. Is the relationship between total number of information sources exposure and HPV vaccine uptake mediated by parental attitudes about HPV vaccine?

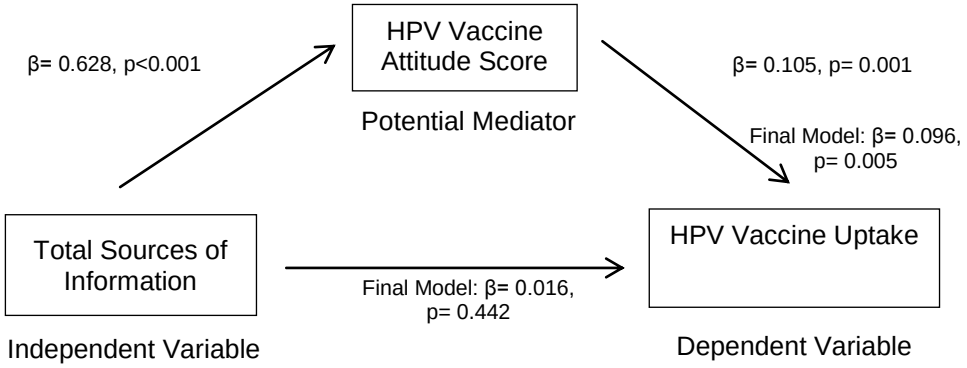
Bivariate analyses conducted for the previous two research questions indicated a mediation analysis was possible. Because total number of information sources was not associated with intention to receive HPV vaccine, mediation was not attempted for this outcome. Additionally, mediation was not attempted among females because the condition of a significant relationship between the independent variable and mediator was not met. Each step of mediation is demonstrated in **Figures 4** for the overall sample and **Figure 5** for males**.** These conceptual models demonstrate that when the mediator is included in the model, the significant relationship between the independent variable and dependent variable is diminished, but the relationship between the mediator and dependent variable remains significant. Thus, the model suggests that the positive relationship between total sources of information and HPV vaccine uptake is explained, in part, by HPV vaccine attitude score.

Figure 4. Estimates of Mediation Effects (Overall Sample)

Bivariate Relationship



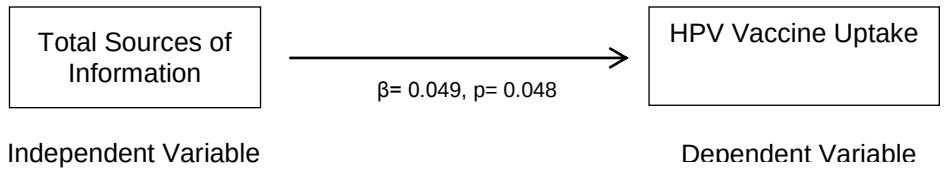
Mediated Relationship



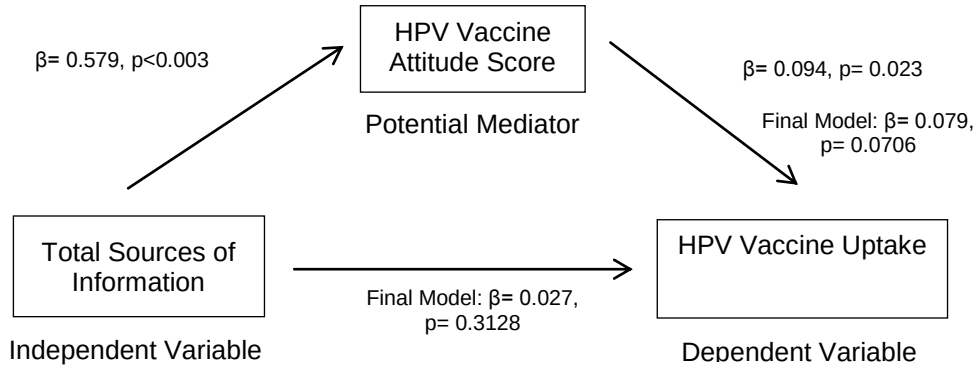
Mediation model demonstrates that among the overall sample, relationship between information sources and HPV vaccine uptake is no longer significant when HPV vaccine attitude score is included in the model; relationship between HPV vaccine attitude score and HPV vaccine uptake remains significant

Figure 5. Estimates of Mediation Effects (Males)

Bivariate Relationship



Mediated Relationship



Mediation model demonstrates that among males, relationship between information sources and HPV vaccine uptake is no longer significant when HPV vaccine attitude score is included in the model. Relationship between HPV vaccine attitude score and HPV vaccine uptake becomes less significant.

CHAPTER V. DISCUSSION

The present study characterizes attitudes and exposure to information about HPV vaccine among a sample of parents in Richmond County, Georgia. This analysis revealed that parents of middle- and high-schoolers held largely positive attitudes towards immunizations in a general sense and towards HPV vaccine specifically. Participants heard about HPV vaccine from numerous sources, demonstrating that HPV vaccine awareness was high. Uptake of HPV vaccine was extremely high among adolescents in this sample, with 72% of girls and 35% of boys receiving at least one dose of the vaccine. Series initiation and series completion were higher in this sample than has been estimated at state and national levels. This result could reflect the racial makeup of the group, as trends in the last several years have shown that African-Americans have been equally or more likely to initiate HPV vaccination compared to other groups. Receipt of at least one dose of HPV vaccine was associated with receipt of a doctor recommendation, higher HPV vaccine attitude score, and greater number of sources of exposure to HPV vaccine information. Nearly 80% of the overall sample reported hearing about HPV vaccine from a doctor or medical professional, and 63% reported that a doctor recommended HPV vaccine for their child. The vast majority of females, but not males, were recommended to receive HPV vaccine by a health care provider. Nevertheless, about 90% of adolescents who received at least one dose of HPV vaccine received a recommendation from a health care provider. This finding is consistent with recent research that shows a patient who receives a provider recommendation is 4-5 times more likely to receive HPV vaccine (Lau, Lin, & Flores, 2012; Ylitalo, Lee, & Mehta, 2013).

In addition to corroborating important findings about provider recommendation, this study enhanced the body of evidence regarding parental attitudes. Perceived susceptibility was low compared with other attitudinal constructs, but was shown to exhibit a significant association with uptake and intention in the overall sample. Perceived severity, however, was reported among over 91% of respondents, but was not significantly associated with the intention or receipt of HPV vaccine. While perceived threat is made up of both constructs, this finding demonstrates that perceived susceptibility may have been a more salient factor for parents in our study. Other research found that knowing peers who were vaccinated was a facilitator of HPV vaccine uptake among African-American adolescent girls (Scarinci et al., 2007), but our findings only partially supported the association of social norms and uptake.

Furthermore, hearing about HPV vaccine from TV and radio were associated with overall HPV vaccine uptake, indicating that broadcast media was a relevant source for this sample. Exposure to HPV vaccine information on TV was reported by two-thirds of respondents, and approximately 43% reported that TV had the greatest impact on deciding to talk to their child's doctor about the HPV vaccine. Given the fact that nearly all parents characterized what they heard about HPV vaccine in the media as mostly positive or neutral, it is promising that these broadcast sources were found to be positively associated with vaccine uptake. Internet and print sources (newspaper or magazine article), however, were identified by many fewer respondents as a source of information, did not frequently rank as one the top two most influential sources or as having the greatest impact on the decision to talk to a doctor about HPV vaccine. Less than half of respondents heard about HPV vaccine from family or friends, but a sizable number valued this source and reported that a recommendation by a friend or family member influenced their decision to vaccinate their

child. The homogeneity of this sample allows for comparison to prior studies that found African-Americans to have a high frequency of exposure to HPV vaccine information on TV (Hughes et al., 2009), and low reported frequency of utilizing the Internet for health information (Laz & Berenson, 2013; Miller et al., 2007; Tu, 2008).

To the author's knowledge, this is the first study that attempted to conduct a mediation analysis with information source exposures and HPV vaccine attitudes. The results from this test demonstrate that the significant dose-response association exhibited between total number of sources of hearing about HPV and receipt of at least one dose of HPV vaccine could be explained by higher (more favorable) HPV vaccine attitude scores. This finding could mean that simply being exposed to information is not sufficient to influence parental decisions about HPV vaccination. It is likely that the content of messages and/or appraisal of the value of a source influence attitudes in meaningful ways that can ultimately affect likelihood of vaccination.

Limitations

This study is cross-sectional in nature and thus, cannot infer causality or assess changes over time. The temporality of information exposure and attitudes cannot be assessed, so it is impossible to know what influence information sources may have had on forming perceptions versus adding to or changing existing perceptions. The study population is from one county in Georgia and the vast majority of participants were African-American and enrolled in Medicaid, so the results may not be generalizable to other locales. With a response rate of 7.4%, it is possible that those who elected to take the survey differed in meaningful ways from those who did not participate in the survey. Most survey respondents

identified themselves as the child's mother, but it is not known if the survey respondent was the person in the household most familiar with the child's medical and vaccination history, which could have affected reliability of the main outcome measures. Validated county-level immunization data from the Georgia Immunization Registry (GRITS) were not available to the researcher at the time of this analysis; thus, all outcome measures are based solely on self-report. It is possible that the high rate of HPV vaccine uptake in this sample may be due to an over-reporting of this outcome, but there are numerous possible explanations including successful public health efforts. Future studies should aim to validate self-report data with registry records whenever possible. Survey fatigue could have biased some respondents' answers, as this set of questions was the last section of the survey. Although the total survey only took about 15 to 20 minutes in duration, future studies inquiring about multiple vaccines should consider utilizing alternate versions of the data collection instrument in which survey sections are varied.

The sample for this study was relatively small and thus, certain sub-group analyses were limited. Since a large number of adolescents had already received HPV vaccine, the number of responses regarding intention to vaccinate was reduced, making differences difficult to detect for this outcome. In addition, interpretations of some findings are limited by the measures used in this study. While this study demonstrated a strong association between provider recommendation and uptake, the strength of recommendation was not assessed. Future research should aim to characterize the doctor-patient interaction further and create a validated measure for strength of recommendation. Furthermore, data gathered about information sources were limited to whether or not the individual had heard about HPV vaccine from each source, but did not assess factors such as cumulative exposure, order of

exposure, or content within each source. Other studies should aim to characterize more dimensions of information sources, including related behaviors such as whether information was sought out actively or reached the individual passively. As the information source categories were not mutually exclusive, it was not appropriate to conduct a logistic regression of all sources in order to assess the relationship with vaccine uptake; therefore, the association between each source and vaccine uptake do not control for other sources. Mediation explains in part the association between total number of information source exposure types and HPV vaccine uptake, but as this research is cross-sectional, it is not a true assessment of the causal pathway. Finally, it is not known whether there were any relevant historical effects that might have influenced any covariates or outcome variables. For example, national or statewide media campaigns may have occurred during this time, which could have influenced respondents' recall of exposure.

Strengths

Despite these limitations, this study has numerous strengths. Primarily, the sample was sufficiently large to investigate differences in the main outcome measure, receipt of HPV vaccine. Although the makeup of this sample is not reflective of the entire state or the nation, the sample reflects the fact that Richmond County is predominately African-American and has a large low-income population. In this regard, results from this study have some generalizability to the county as a whole or to similar sociodemographic populations. Additionally, many of the measures in this survey were theory-driven and successfully utilized by the research group in previous studies of adolescent immunization within this population. Response options to the items about information sources were robust and allowed for more critical assessment than studies that offered fewer categories. Mass media sources

were described as non-drug advertisements, as to distinguish content and remind participants of less easily recalled material, such as a TV news report. Many items allowed for respondents to provide a response that was not listed, which were recorded verbatim by researchers. These answers were reviewed and confirmed to be distinct from the pre-determined responses. Furthermore, CATI technology provided a safe and reliable mechanism for data collection, as the software presented easy-to-follow skip patterns that minimized missing responses and data entry errors, and preserved the data quality for analysis. Although telephone interviews have the potential to introduce social desirability bias, the research team considered this an acceptable tradeoff in consideration of the numerous benefits of the technology.

Implications

The findings from this study add to the existing pool of evidence that parental attitudes, exposure to information about HPV vaccine, and provider recommendation are important covariates of HPV vaccine uptake. From this analysis we also learned that the proportion of respondents reporting receipt of a physician recommendation for HPV vaccine was higher than that of the baseline survey conducted by colleagues at the Emory Vaccine Center in 2011 (Gargano et al., 2013). Since this finding is not likely to be related to the intervention trial itself, this increase could reflect a change in practice on the part of providers in Richmond County to increase the frequency or strength of recommendations for adolescents to receive HPV vaccine. This may be the result of a push by local or state health authorities, reduced barriers for providers to offer the vaccine (such as enrollment in Vaccines for Children, a federal entitlement program that guarantees payment for ACIP-

recommended vaccines), or more opportunities for health care professionals to learn about the value of recommending the vaccine and how to have this discussion with patients and parents. Moreover, interested or curious parents may have initiated discussion with their health care provider about the issue, ultimately leading to a recommendation.

The high reported frequency of physician recommendation in this sample is promising considering a recent call-to-action by several professional organizations and the CDC to enhance the number of providers who give a strong recommendation in favor of HPV vaccine. A "Dear Colleague" letter released in February 2014 insisted "what you say matters; how you say it matters even more" ("Give a strong recommendation for HPV vaccine to increase uptake!," 2014). The letter, targeted at family physicians, pediatricians, OB/GYNs, and other health care professionals, acknowledged the crucial role of the health care provider in increasing adolescent uptake of HPV vaccine, and urged health care professionals to refer to a CDC tip sheet and other resources to aid in improving their communication skills. If providers can optimize the time spent with patients and parents by adequately describing the benefits of HPV vaccination and offering a strong and clear recommendation, uptake rates may increase. Our findings reflect that providers may already be recommending HPV vaccine at a high level, but this push may be especially important among adolescent males, who received a physician recommendation at a much lower frequency than females. Provider barriers to recommending HPV vaccine are mostly financially related, including cost of stocking the vaccine and perception of low reimbursement rates (Daley et al., 2010). A recent study found this to be true among Vaccines for Children program providers in Georgia (Luque, Tarasenko, Dixon, Vogel, & Tedders, 2014); thus, greater efforts are needed to address these challenges on an institutional

level. Interestingly, a significantly higher proportion of parents of boys reported that receiving a recommendation from the health department influenced their decision to vaccinate their child compared to parents of girls. This could indicate that more males interfaced with the health department rather than another type of health care location, or that health departments systematically recommended HPV immunization in a way that reduced missed opportunities.

With regard to attitudes, the findings of this study largely support the theories used. Injunctive social norms were significantly associated with HPV vaccine uptake and intention, but descriptive norms were only associated with intention to vaccinate. As social norms were reported at a lower frequency than many other attitudinal constructs, public health professionals could consider ways to enhance norms around HPV vaccination. This might include using messages or activities that might prompt positive discussion among family and peer groups. It is promising that overall, parents felt vaccines were safe, as concerns over safety have been a major driver of non-receipt on a national level in the latest estimates (Darden et al., 2013). Messages should acknowledge safety concerns alongside the benefits of the vaccine; ignoring safety altogether might lead to a lack of trust from public health or medical authorities. The HBM posits that both perceived severity and perceived susceptibility comprise the overall threat, but our findings demonstrate that perceived susceptibility may be a better emphasis for future health messaging in this population since perceived severity was already extremely high across the board.

Finally, this study has several implications for health communication regarding HPV immunization. Because internet and social media are newer forms of communication that have the potential to reach a great number of people at a low cost, there is a lot of emphasis

on their potential role in health communications and behavioral interventions. Among this sample, internet was not found to be a significant source of HPV information among parents, nor was it considered a valued source. Given the demographics of this sample, it is important to recognize that widespread campaigns delivered solely on the internet may not be an effective approach for all populations and could even widen existing disparities in HPV infection outcomes that are known to be racially and socially patterned (Kontos et al., 2012). Promotional materials, public health messages, and activities that encourage the audience to seek out more information on a specific website should acknowledge that the internet is not a valued source for all persons, and should consider effective ways for the information to reach participants in a more passive manner. Broadcast media, which delivers messages passively to an audience, may be one of the best avenues to reach parents of minority or low-income adolescents. Other research shows that African-Americans are more likely than Whites to have heard about HPV vaccine from a broadcast source (Hughes et al., 2009). Health communication professionals might consider developing PSAs for dissemination on TV and radio. In order for these messages to influence attitudes, benefits of HPV vaccine should continue to be emphasized alongside the perceived threat of HPV infection and incorporation of positive social norms surrounding immunization. Messages might work by prompting parents to talk to their child's health care provider, which could facilitate the opportunity for a recommendation to occur. To increase series completion rates, broadcast media might be utilized to deliver brief messages reminding parents to take their child for an appointment for their 2nd or 3rd shot. Providing a cue to action through a medium that is already known to have had some success in reaching parents could be an effective strategy for this population. Future work should focus on meaningful cues to action through various delivery channels.

Although the results of this study are most appropriately generalized to a low-income African-American population, the findings from this study have shed light on the role of various sources of information and attitudes that may influence parents' decisions to have their child receive HPV vaccine. In this day and age where information is accessible from a great variety of avenues, it is important for public health professionals to select methods of dissemination that are likely to resonate with the target audience. This study underscores the importance of considering both message content and the source of delivery when developing effective strategies to increase HPV vaccine uptake.

References

Akers, A. Y., Newmann, S. J., & Smith, J. S. (2007). Factors Underlying Disparities in Cervical Cancer Incidence, Screening, and Treatment in the United States. *Current Problems in Cancer, 31*(3), 157-181.

Allen, J. D., de Jesus, M., Mars, D., Tom, L., Cloutier, L., & Shelton, R. C. (2012). Decision-Making about the HPV Vaccine among Ethnically Diverse Parents: Implications for Health Communications. *J Oncol, 2012,* 401979. doi: 10.1155/2012/401979

Allen, J. D., Othus, M. K., Shelton, R. C., Li, Y., Norman, N., Tom, L., & del Carmen, M. G. (2010). Parental decision making about the HPV vaccine. *Cancer Epidemiol Biomarkers Prev, 19*(9), 2187-2198. doi: 10.1158/1055-9965.EPI-10-0217

Arnold, L. D., Sanders, V.L., and Thompson, S. (2012). Racial and global disparities in human papillomvarius infection and cervical cancer. In S. R. Nataro (Ed.), *Health Disparities Among Under-served Populations: Implications for Research, Policy, and Praxis (Advances in Education in Diverse Communities: Research, Policy, and Praxis, Volume 9)* (Vol. 9): Emerald Group Publishing Ltd.

Bair, R. M., Mays, R. M., Sturm, L. A., & Zimet, G. D. (2008). Acceptability of the human papillomavirus vaccine among Latina mothers. *J Pediatr Adolesc Gynecol, 21*(6), 329-334. doi: 10.1016/j.jpag.2008.02.007

Baldwin, A. S., Bruce, C. M., & Tiro, J. A. (2012). Understanding how Mothers of Adolescent Girls Obtain Information About the HPV Vaccine: Associations Between Mothers' Health Beliefs, Information Seeking, and Vaccination Intentions in an Ethnically Diverse Sample. *J Health Psychol*. doi: 10.1177/1359105312445078

Bednarczyk, R. A., Curran, E. A., Orenstein, W. A., & Omer, S. B. (2013). Health disparities in human papillomavirus vaccine coverage: Trends analysis from NIS-Teen, 2008-2011. *Clin Infect Dis*. doi: 10.1093/cid/cit707

Berenson, A. B., & Rahman, M. (2012). Gender differences among low income women in their intent to vaccinate their sons and daughters against human papillomavirus infection. *J Pediatr Adolesc Gynecol, 25*(3), 218-220. doi: 10.1016/j.jpag.2012.01.003

Brewer, N. T., & Fazekas, K. I. (2007). Predictors of HPV vaccine acceptability: a theory-informed, systematic review. *Prev Med, 45*(2-3), 107-114. doi: 10.1016/j.ypmed.2007.05.013

Brewer, N. T., Gottlieb, S. L., Reiter, P. L., McRee, A. L., Liddon, N., Markowitz, L., & Smith, J. S. (2011). Longitudinal predictors of human papillomavirus vaccine initiation among adolescent girls in a high-risk geographic area. *Sex Transm Dis, 38*(3), 197-204. doi: 10.1097/OLQ.0b013e3181f12dbf

Briones, R., Nan, X., Madden, K., & Waks, L. (2012). When vaccines go viral: an analysis of HPV vaccine coverage on YouTube. *Health Commun, 27*(5), 478-485. doi: 10.1080/10410236.2011.610258

Casciotti, D. M., Smith, K. C., Andon, L., Vernick, J., Tsui, A., & Klassen, A. C. (2014). Print news coverage of school-based human papillomavirus vaccine mandates. *Journal of School Health, 84*(2), 71-81.

Casciotti, D. M., Smith, K. C., Tsui, A., & Klassen, A. C. (2014). Discussions of adolescent sexuality in news media coverage of the HPV vaccine. *J Adolesc, 37*(2), 133-143. doi: 10.1016/j.adolescence.2013.11.004

Casillas, A., Singhal, R., Tsui, J., Glenn, B. A., Bastani, R., & Mangione, C. M. (2011). The impact of social communication on perceived HPV vaccine effectiveness in a low-income, minority population. *Ethn Dis, 21*(4), 495-501.

Caskey, R., Lindau, S. T., & Alexander, G. C. (2009). Knowledge and Early Adoption of the HPV Vaccine Among Girls and Young Women: Results of a National Survey. *Journal of Adolescent Health, 45*(5), 453-462.

Cates, J. R., Shafer, A., Carpentier, F. D., Reiter, P. L., Brewer, N. T., McRee, A. L., & Smith, J. S. (2010). How parents hear about human papillomavirus vaccine: implications for uptake. *J Adolesc Health, 47*(3), 305-308. doi: 10.1016/j.jadohealth.2010.04.003

CDC. (2011). Recommendations on the Use of Quadrivalent Human Papillomavirus Vaccine in Males — Advisory Committee on Immunization Practices (ACIP), 2011. *MMWR, 60*(50), 1705-1708.

CDC. (2012). Human Papillomavirus-Associated Cancers - United States, 2004 - 2008. *MMWR, 61*(15), 258-261.

CDC. (2013a). Genital HPV Infection - Fact Sheet. from http://www.cdc.gov/std/hpv/stdfact-hpv.htm

CDC. (2013b). Human Papillomavirus Vaccination Coverage Among Adolescent Girls, 2007–2012, and Postlicensure Vaccine Safety Monitoring, 2006–2013 — United States. *MMWR, 62*(29), 591-595.

CDC. (2013c). National and State Vaccination Coverage Among Adolescents Aged 13 Through 17 Years -- United States, 2012. *MMWR, 62*(34), 685-693.

Champion, V. L., & Skinner, C. S. (2008). The Health Belief Model. In R. Glanz, and Viswanath (Ed.), *Health Behavior and Health Education: Theory, Research, and Practice* (4th ed., pp. 46). San Francisco: Jossey-Bass.

Chaturvedi, A. K., Engels, E. A., Pfeiffer, R. M., Hernandez, B. Y., Xiao, W., Kim, E., . . . Gillison, M. L. (2011). Human papillomavirus and rising oropharyngeal cancer incidence in the United States. *J Clin Oncol, 29*(32), 4294-4301. doi: 10.1200/JCO.2011.36.4596

Chou, B., Krill, L. S., Horton, B. B., Barat, C. E., & Trimble, C. L. (2011). Disparities in human papillomavirus vaccine completion among vaccine initiators. *Obstet Gynecol, 118*(1), 14-20. doi: 10.1097/AOG.0b013e318220ebf3

Conroy, K., Rosenthal, S. L., Zimet, G. D., Jin, Y., Bernstein, D. I., Glynn, S., & Kahn, J. A. (2009). Human papillomavirus vaccine uptake, predictors of vaccination, and self-reported barriers to vaccination. *J Womens Health (Larchmt), 18*(10), 1679-1686. doi: 10.1089/jwh.2008.1329

Daley, M. F., Crane, L. A., Markowitz, L. E., Black, S. R., Beaty, B. L., Barrow, J., . . . Kempe, A. (2010). Human papillomavirus vaccination practices: a survey of US physicians 18 months after licensure. *Pediatrics, 126*(3), 425-433. doi: 10.1542/peds.2009-3500

Darden, P. M., Thompson, D. M., Roberts, J. R., Hale, J. J., Pope, C., Naifeh, M., & Jacobson, R. M. (2013). Reasons for not vaccinating adolescents: national

immunization survey of teens, 2008-2010. *Pediatrics, 131*(4), 645-651. doi: 10.1542/peds.2012-2384

de Visser, R., Waites, L., Parikh, C., & Lawrie, A. (2011). The importance of social norms for uptake of catch-up human papillomavirus vaccination in young women. *Sex Health, 8*(3), 330-337. doi: 10.1071/sh10155

Dempsey, A. F., Zimet, G. D., Davis, R. L., & Koutsky, L. (2006). Factors that are associated with parental acceptance of human papillomavirus vaccines: a randomized intervention study of written information about HPV. *Pediatrics, 117*(5), 1486-1493. doi: 10.1542/peds.2005-1381

Denny, L. (2013). Safety of HPV vaccination: A FIGO statement. *Int J Gynaecol Obstet, 123*(3), 187-188. doi: 10.1016/j.ijgo.2013.09.009

Dillard, J. P. (2011). An application of the integrative model to women's intention to be vaccinated against HPV: implications for message design. *Health Commun, 26*(5), 479-486. doi: 10.1080/10410236.2011.554170

Dillner, J., Kjaer, S. K., Wheeler, C. M., Sigurdsson, K., Iversen, O. E., Hernandez-Avila, M., . . . Haupt, R. (2010). Four year efficacy of prophylactic human papillomavirus quadrivalent vaccine against low grade cervical, vulvar, and vaginal intraepithelial neoplasia and anogenital warts: randomised controlled trial. *BMJ, 341*, c3493. doi: 10.1136/bmj.c3493

Dorell, C., Yankey, D., Kennedy, A., & Stokley, S. (2013). Factors that influence parental vaccination decisions for adolescents, 13 to 17 years old: National Immunization Survey-Teen, 2010. *Clin Pediatr (Phila), 52*(2), 162-170. doi: 10.1177/0009922812468208

Eaton, D. K., Kann, L., Kinchen, S., Shanklin, S., Flint, K. H., Hawkins, J., . . . Prevention. (2012). Youth risk behavior surveillance - United States, 2011. *Morbidity and mortality weekly report. Surveillance summaries (Washington, D.C. : 2002), 61*(4), 1-162.

FDA. (2011). Highlights of prescribing information. Gardasil (human papillomavirus quadrivalent [types 6, 11, 16 and 18]). Retrieved December 16, 2012, from http://www.fda.gov/downloads/biologicsbloodvaccines/vaccines/approvedproducts/ucm111263.pdf

Flores, K., & Bencomo, C. (2009). Preventing cervical cancer in the Latina population. *J Womens Health (Larchmt), 18*(12), 1935-1943. doi: 10.1089/jwh.2008.1151

Gainforth, H. L., Cao, W., & Latimer-Cheung, A. E. (2012). Message Framing and Parents' Intentions to have their Children Vaccinated Against HPV. *Public Health Nursing, 29*(6), 542-552. doi: 10.1111/j.1525-1446.2012.01038.x

Gargano, L. M., Herbert, N. L., Painter, J. E., Sales, J. M., Morfaw, C., Rask, K., . . . Hughes, J. M. (2013). Impact of a physician recommendation and parental immunization attitudes on receipt or intention to receive adolescent vaccines. *Hum Vaccin Immunother, 9*(12), 2627-2633. doi: 10.4161/hv.25823

Gillison, M. L. B., T.; Pickard, R. K.; Tong, Z. Y.; Xiao, W.; Kahle, L.; Graubard, B. I.; Chaturvedi, A. K. (2012). Prevalence of oral HPV infection in the United States, 2009-2010. *JAMA, 307*(7), 693-703. doi: 10.1001/jama.2012.101

Giuliano, A. R., Tortolero-Luna, G., Ferrer, E., Burchell, A. N., de Sanjose, S., Kjaer, S. K., . . . Bosch, F. X. (2008). Epidemiology of human papillomavirus infection in men,

cancers other than cervical and benign conditions. *Vaccine, 26 Suppl 10*, K17-28. doi: 10.1016/j.vaccine.2008.06.021

Give a strong recommendation for HPV vaccine to increase uptake! (2014). Retrieved 30 March, 2014, from http://www.aafp.org/dam/AAFP/documents/patient_care/immunizations/hpv-recommendation-letter.pdf

Gowda, C. C., R. C.; Butchart, A. T.; Singer, D. C.; Davis, M. M.; Clark, S. J.; Dempsey, A. F. (2012). CHIAS: a standardized measure of parental HPV immunization attitudes and beliefs and its associations with vaccine uptake. *Sex Transm Dis, 39*(6), 475-481. doi: 10.1097/OLQ.0b013e318248a6d5

Grabiel, M., Reutzel, T. J., Wang, S., Rubin, R., Leung, V., Ordonez, A., . . . Jordan, E. (2013). HPV and HPV Vaccines: The Knowledge Levels, Opinions, and Behavior of Parents. *J Community Health, 38*(6), 1015-1021. doi: 10.1007/s10900-013-9725-6

Griffioen, A. M., Glynn, S., Mullins, T. K., Zimet, G. D., Rosenthal, S. L., Fortenberry, J. D., & Kahn, J. A. (2012). Perspectives on decision making about human papillomavirus vaccination among 11- to 12-year-old girls and their mothers. *Clin Pediatr (Phila), 51*(6), 560-568. doi: 10.1177/0009922812443732

Haber, G., Malow, R. M., & Zimet, G. D. (2007). The HPV vaccine mandate controversy. *J Pediatr Adolesc Gynecol, 20*(6), 325-331. doi: 10.1016/j.jpag.2007.03.101

Hamlish, T., Clarke, L., & Alexander, K. A. (2012). Barriers to HPV immunization for African American adolescent females. *Vaccine, 30*(45), 6472-6476. doi: 10.1016/j.vaccine.2012.07.085

Hariri, S., Unger, E. R., Sternberg, M., Dunne, E. F., Swan, D., Patel, S., & Markowitz, L. E. (2011). Prevalence of genital human papillomavirus among females in the United States, the National Health And Nutrition Examination Survey, 2003-2006. *J Infect Dis, 204*(4), 566-573. doi: 10.1093/infdis/jir341

Hendry, M., Lewis, R., Clements, A., Damery, S., & Wilkinson, C. (2013). "HPV? Never heard of it!": A systematic review of girls' and parents' information needs, views and preferences about human papillomavirus vaccination. *Vaccine, 31*(45), 5152-5167. doi: 10.1016/j.vaccine.2013.08.091

Hughes, J., Cates, J. R., Liddon, N., Smith, J. S., Gottlieb, S. L., & Brewer, N. T. (2009). Disparities in how parents are learning about the human papillomavirus vaccine. *Cancer Epidemiol Biomarkers Prev, 18*(2), 363-372. doi: 10.1158/1055-9965.epi-08-0418

Jeudin, P., Liveright, E., Del Carmen, M. G., & Perkins, R. B. (2013). Race, ethnicity and income as factors for HPV vaccine acceptance and use. *Hum Vaccin Immunother, 9*(7), 1413-1420. doi: 10.4161/hv.24422

Jeudin, P., Liveright, E., Del Carmen, M. G., & Perkins, R. B. (2014). Race, ethnicity, and income factors impacting human papillomavirus vaccination rates. *Clin Ther, 36*(1), 24-37. doi: 10.1016/j.clinthera.2013.11.001

Joseph, N. P., Clark, J. A., Bauchner, H., Walsh, J. P., Mercilus, G., Figaro, J., . . . Perkins, R. B. (2012). Knowledge, Attitudes, and Beliefs Regarding HPV Vaccination: Ethnic and Cultural Differences Between African-American and Haitian Immigrant Women. *Womens Health Issues, 22*(6), e571-579. doi: 10.1016/j.whi.2012.09.003

Katz, M. L., Reiter, P. L., Heaner, S., Ruffin, M. T., Post, D. M., & Paskett, E. D. (2009). Acceptance of the HPV vaccine among women, parents, community leaders, and

healthcare providers in Ohio Appalachia. *Vaccine, 27*(30), 3945-3952. doi: 10.1016/j.vaccine.2009.04.040

Keelan, J., Pavri, V., Balakrishnan, R., & Wilson, K. (2010). An analysis of the Human Papilloma Virus vaccine debate on MySpace blogs. *Vaccine, 28*(6), 1535-1540. doi: 10.1016/j.vaccine.2009.11.060

Kelly, B. J., Leader, A. E., Mittermaier, D. J., Hornik, R. C., & Cappella, J. N. (2009). The HPV vaccine and the media: how has the topic been covered and what are the effects on knowledge about the virus and cervical cancer? *Patient Educ Couns, 77*(2), 308-313. doi: 10.1016/j.pec.2009.03.018

Kjaer, S. K., Sigurdsson, K., Iversen, O. E., Hernandez-Avila, M., Wheeler, C. M., Perez, G., . . . Haupt, R. M. (2009). A pooled analysis of continued prophylactic efficacy of quadrivalent human papillomavirus (Types 6/11/16/18) vaccine against high-grade cervical and external genital lesions. *Cancer Prev Res (Phila), 2*(10), 868-878. doi: 10.1158/1940-6207.CAPR-09-0031

Kontos, E. Z., Emmons, K. M., Puleo, E., & Viswanath, K. (2012). Contribution of communication inequalities to disparities in human papillomavirus vaccine awareness and knowledge. *Am J Public Health, 102*(10), 1911-1920. doi: 10.2105/ajph.2011.300435

Lacey, C. J., Lowndes, C. M., & Shah, K. V. (2006). Chapter 4: Burden and management of non-cancerous HPV-related conditions: HPV-6/11 disease. *Vaccine, 24 Suppl 3*, S3/35-41. doi: 10.1016/j.vaccine.2006.06.015

Lau, M., Lin, H., & Flores, G. (2012). Factors associated with human papillomavirus vaccine-series initiation and healthcare provider recommendation in US adolescent females: 2007 National Survey of Children's Health. *Vaccine, 30*(20), 3112-3118. doi: 10.1016/j.vaccine.2012.02.034

Laz, T. H., & Berenson, A. B. (2013). Racial and ethnic disparities in internet use for seeking health information among young women. *J Health Commun, 18*(2), 250-260. doi: 10.1080/10810730.2012.707292

Leader, A. E., Cashman, R., Voytek, C. D., Baker, J. L., Brawner, B. M., & Frank, I. (2011). An exploratory study of adolescent female reactions to direct-to-consumer advertising: the case of the Human Papillomavirus (HPV) Vaccine. *Health Mark Q, 28*(4), 372-385. doi: 10.1080/07359683.2011.630289

Litton, A. G., Desmond, R. A., Gilliland, J., Huh, W. K., & Franklin, F. A. (2011). Factors associated with intention to vaccinate a daughter against HPV: a statewide survey in Alabama. *J Pediatr Adolesc Gynecol, 24*(3), 166-171. doi: 10.1016/j.jpag.2011.01.004

Luque, J. S., Tarasenko, Y. N., Dixon, B. T., Vogel, R. L., & Tedders, S. H. (2014). Recommendations and Administration of the HPV Vaccine to 11- to 12-Year-Old Girls and Boys: A Statewide Survey of Georgia Vaccines for Children Provider Practices. *J Low Genit Tract Dis*. doi: 10.1097/LGT.0000000000000011

Macartney, K. K., Chiu, C., Georgousakis, M., & Brotherton, J. M. (2013). Safety of human papillomavirus vaccines: a review. *Drug Saf, 36*(6), 393-412. doi: 10.1007/s40264-013-0039-5

Madden, K., Nan, X., Briones, R., & Waks, L. (2012). Sorting through search results: a content analysis of HPV vaccine information online. *Vaccine, 30*(25), 3741-3746. doi: 10.1016/j.vaccine.2011.10.025

McRee, A. L., Brewer, N. T., Reiter, P. L., Gottlieb, S. L., & Smith, J. S. (2010). The Carolina HPV Immunization Attitudes and Beliefs Scale (CHIAS): Scale Development and Associations With Intentions to Vaccinate. *Sex Transm Dis, 37*(4), 234-239. doi: 10.1097/OLQ.0b013e3181c37e15

Miller, E. A., West, D. M., & Wasserman, M. (2007). Health information Websites: characteristics of US users by race and ethnicity. *J Telemed Telecare, 13*(6), 298-302. doi: 10.1258/135763307781644915

Montano, D. E., and Kasprzyk, D. (2008). Theory of Reasoned Action, Theory of Planned Behavior, and the Integrated Behavioral Model In R. Glanz, and Viswanath (Ed.), *Health Behavior and Health Education: Theory, Research, and Practice* (4th ed.). San Francisco: Jossey-Bass.

Morin, A., Lemaitre, T., Farrands, A., Carrier, N., & Gagneur, A. (2012). Maternal knowledge, attitudes and beliefs regarding gastroenteritis and rotavirus vaccine before implementing vaccination program: which key messages in light of a new immunization program? *Vaccine, 30*(41), 5921-5927. doi: 10.1016/j.vaccine.2012.07.050

National Cancer Institute. (2014). SEER Stat Fact Sheets: Cervix Uteri Cancer. Retrieved 1 March, 2014, from http://seer.cancer.gov/statfacts/html/cervix.html

Noar, S. M., & Zimmerman, R. S. (2005). Health Behavior Theory and cumulative knowledge regarding health behaviors: are we moving in the right direction? *Health Educ Res, 20*(3), 275-290. doi: 10.1093/her/cyg113

Ohri, L. K. (2007). HPV vaccine: immersed in controversy. *Ann Pharmacother, 41*(11), 1899-1902. doi: 10.1345/aph.1K247

Painter, J. E., Sales, J. M., Pazol, K., Wingood, G. M., Windle, M., Orenstein, W. A., & DiClemente, R. J. (2010). Psychosocial correlates of intention to receive an influenza vaccination among rural adolescents. *Health Educ Res, 25*(5), 853-864. doi: 10.1093/her/cyq037

Palefsky, J. M., Giuliano, A. R., Goldstone, S., Moreira, E. D., Jr., Aranda, C., Jessen, H., . . . Garner, E. I. (2011). HPV vaccine against anal HPV infection and anal intraepithelial neoplasia. *N Engl J Med, 365*(17), 1576-1585. doi: 10.1056/NEJMoa1010971

Perkins, R. B., Pierre-Joseph, N., Marquez, C., Iloka, S., & Clark, J. A. (2010). Why do low-income minority parents choose human papillomavirus vaccination for their daughters? *Journal of Pediatrics, 157*(4), 617-622.

Perkins, R. B., Tipton, H., Shu, E., Marquez, C., Belizaire, M., Porter, C., . . . Pierre-Joseph, N. (2013). Attitudes Toward HPV Vaccination Among Low-Income and Minority Parents of Sons: A Qualitative Analysis. *Clin Pediatr (Phila), 52*(3), 231-240. doi: 10.1177/0009922812473775

Petty, T. J., Callahan, S. T., Chen, Q., Edwards, K. M., & Dempsey, A. F. (2010). Assessment of parental acceptance of a potential cytomegalovirus vaccine for adolescent females. *Vaccine, 28*(35), 5686-5690. doi: 10.1016/j.vaccine.2010.06.051

Pew Research Center. (2009). The shared search for health information on the Internet. Retrieved 1 March, 2014 from http://pewresearch.org/pubs/1248/americans-look-online-for-health-information

Rambout, L., Tashkandi, M., Hopkins, L., & Tricco, A. C. (2013). Self-reported barriers and facilitators to preventive human papillomavirus vaccination among adolescent girls

and young women: A systematic review. *Prev Med*. doi: 10.1016/j.ypmed.2013.10.009

Reiter, P. L., Brewer, N. T., Gottlieb, S. L., McRee, A. L., & Smith, J. S. (2009). Parents' health beliefs and HPV vaccination of their adolescent daughters. *Soc Sci Med, 69*(3), 475-480. doi: 10.1016/j.socscimed.2009.05.024

Rosenstock, I. (1974). Historical origins of the health belief model. *Health Education Monographs, 2*(4).

Rosenthal, S. L., Rupp, R., Zimet, G. D., Meza, H. M., Loza, M. L., Short, M. B., & Succop, P. A. (2008). Uptake of HPV vaccine: demographics, sexual history and values, parenting style, and vaccine attitudes. *J Adolesc Health, 43*(3), 239-245. doi: 10.1016/j.jadohealth.2008.06.009

Scarinci, I. C., Garces-Palacio, I. C., & Partridge, E. E. (2007). An examination of acceptability of HPV vaccination among African American women and Latina immigrants. *J Womens Health (Larchmt), 16*(8), 1224-1233. doi: 10.1089/jwh.2006.0175

Shahrabani, S., & Benzion, U. (2012). How experience shapes health beliefs: the case of influenza vaccination. *Health Educ Behav, 39*(5), 612-619. doi: 10.1177/1090198111427411

Szarewski, A., Poppe, W. A., Skinner, S. R., Wheeler, C. M., Paavonen, J., Naud, P., . . . Dubin, G. (2012). Efficacy of the human papillomavirus (HPV)-16/18 AS04-adjuvanted vaccine in women aged 15-25 years with and without serological evidence of previous exposure to HPV-16/18. *Int J Cancer, 131*(1), 106-116. doi: 10.1002/ijc.26362

Trim, K., Nagji, N., Elit, L., & Roy, K. (2012). Parental Knowledge, Attitudes, and Behaviours towards Human Papillomavirus Vaccination for Their Children: A Systematic Review from 2001 to 2011. *Obstet Gynecol Int, 2012*, 921236. doi: 10.1155/2012/921236

Tu, H. T., & Cohen, G.R. (2008). Striking jump in consumers seeking health care information. In Center for Studying Health Systems Change (Ed.). Washington, DC.

Vadaparampil, S. T., Kahn, J. A., Salmon, D., Lee, J. H., Quinn, G. P., Roetzheim, R., . . . Giuliano, A. R. (2011). Missed clinical opportunities: Provider recommendations for HPV vaccination for 11-12 year old girls are limited. *Vaccine, 29*(47), 8634-8641.

Viswanath, K., Breen, N., Meissner, H., Moser, R. P., Hesse, B., Steele, W. R., & Rakowski, W. (2006). Cancer knowledge and disparities in the information age. *J Health Commun, 11 Suppl 1*, 1-17. doi: 10.1080/10810730600977517

Ylitalo, K. R., Lee, H., & Mehta, N. K. (2013). Health care provider recommendation, human papillomavirus vaccination, and race/ethnicity in the US National Immunization Survey. *Am J Public Health, 103*(1), 164-169. doi: 10.2105/AJPH.2011.300600

Ziarnowski, K. L., Brewer, N. T., & Weber, B. (2009). Present choices, future outcomes: anticipated regret and HPV vaccination. *Prev Med, 48*(5), 411-414. doi: 10.1016/j.ypmed.2008.10.006

Appendix 1. Application of Theoretical Constructs

ATTITUDES AND BELIEFS ABOUT HPV VACCINE	
Construct	**Please respond whether you believe this statement is 'true' or 'false.'**
Perceived severity (HBM)	"The HPV infection can cause a serious disease."
Perceived susceptibility (HBM)	"My child is very likely to get HPV."
Perceived benefits (HBM)	"The HPV vaccine is very effective at preventing cervical cancer."
Injunctive norms (IBM)	"Most people important to me think I should give my child a HPV vaccine."
Injunctive norms (IBM)	"Children should be vaccinated against HPV."
Descriptive norms (IBM)	"Most of the parents I know take their children for HPV vaccine."

Table 2. Sociodemographic Characteristics of Sample

	Total, frequencies		Frequencies by Study Arm						Frequencies by Gender					
	(n=129)		Control (n=40)		Parent Only Arm (n=40)		Parent & Adolescent (n=47)				Female (n=64)		Male (n=65)			
	N	%	N	%	N	%	N	%	χ^2	p-value	N	%	N	%	χ^2	p-value
Respondent's Relation to Child																
Mother	111	86.0%	37	92.5%	38	90.5%	36	76.6%	n/a	0.029 *	59	92.2%	52	80.0%	n/a	0.020 *
Father	8	6.2%	3	7.5%	3	7.1%	2	4.3%			1	1.6%	7	10.8%		
Other	10	7.8%	0	0.0%	1	2.4%	9	19.1%			4	6.3%	6	9.2%		
Gender																
Female	64	49.6%	21	52.5%	19	45.2%	24	51.1%	0.49	0.781						
Male	65	50.4%	19	47.5%	23	54.8%	23	48.9%								
Race																
Caucasian	12	9.3%	2	5.0%	3	7.1%	7	14.9%	n/a	0.325	4	6.3%	8	12.3%	n/a	0.519
African-American	114	88.4%	38	95%	38	90.5%	38	80.9%			58	90.6%	56	86.2%		
Hispanic	0	0.0%	0	0.0%	0	0.0%	0	0.0%			0	0.0%	0	0.0%		
Other	3	2.3%	0	0.0%	1	2.4%	2	4.3%			2	3.1%	1	1.5%		
Insurance																
Medicaid	95	73.6%	28	70.0%	30	71.4%	37	78.7%	n/a	0.330	47	73.4%	48	73.9%	n/a	1.000
Private Insurance	28	21.7%	11	27.5%	10	23.8%	7	14.9%			14	21.9%	14	21.5%		
No Insurance	5	3.9%	0	0.0%	2	4.8%	3	6.4%			3	4.7%	2	3.1%		
Other	1	0.8%	1	2.5%	0	0.0%	0	0.0%			0	0.0%	1	1.5%		
Grade in school																
6	22	17.1%	10	25.0%	4	9.5%	8	17.0%	n/a	0.395	12	18.8%	10	15.4%	10.43	0.108
7	27	20.9%	9	22.5%	9	21.4%	9	19.2%			10	15.6%	17	26.2%		
8	26	20.2%	9	22.5%	8	19.1%	9	19.2%			14	21.9%	12	18.5%		
9	17	13.2%	2	5.0%	10	23.8%	5	10.6%			13	20.3%	4	6.2%		
10	17	13.2%	6	5.0%	5	11.9%	6	12.8%			8	12.5%	9	13.9%		
11	15	11.6%	4	5.0%	5	11.9%	6	12.8%			4	6.3%	11	16.9%		
12	5	3.9%	0	5.0%	1	2.4%	4	8.5%			3	4.7%	2	3.1%		
Age (years)																
Mean (SD)	14.25 (1.9)		13.85		14.29		14.38			0.441	14.21 (1.85)		14.17 (2.20)			0.918

*p ≤ 0.05; n/a indicates where a Fisher's exact test was used due to low expected cell count (no test statistic produced)

Table 3. General Attitudes Towards Immunizations

	Total, Frequencies		Frequencies by Study Arm							Frequencies by Gender					
	(n=129)		Control (n=40)		Parent Only (n=42)		Parent & Adolescent (n=47)			Female (n=64)		Male (n=65)			
Attitude Items	N	%	N	%	N	%	N	%	χ^2	p-value	N	%	N	%	χ^2	p-value
Pre-teens and teens should only be immunized against serious disease																
False	98	76.0%	36	90.0%	29	69.1%	33	70.2%			52	81.3%	46	70.8%		
True	31	24.0%	4	10.0%	13	31.0%	14	29.8%	6.27	0.044 *	12	18.8%	19	29.2%	1.94	0.164
Immunizations are always proven safe before they are approved for use																
False	23	17.8%	7	17.5%	11	26.2%	5	10.6%			13	20.3%	10	15.4%		
True	106	82.2%	33	82.5%	31	73.8%	42	89.4%	3.67	0.160	51	79.7%	55	84.6%	0.53	0.465
My child's immune system could be weakened by too many immunizations																
False	101	78.3%	32	80.0%	34	81.0%	35	74.5%			45	70.3%	56	86.2%		
True	28	21.7%	8	20.0%	8	19.1%	12	25.5%	0.65	0.723	19	29.7%	9	13.9%	4.76	0.029 *
My child could get sick from the vaccine itself																
False	47	36.4%	11	27.5%	16	38.1%	20	42.6%			24	37.5%	23	35.4%		
True	82	63.6%	29	72.5%	26	61.9%	27	57.5%	2.19	0.335	40	62.5%	42	64.6%	0.06	0.803
I would get my child vaccinated only if the vaccine was required for school entry																
False	82	64.1%	26	65.0%	27	64.3%	29	63.0%			46	71.9%	36	56.3%		
True	46	35.9%	14	35.0%	15	35.7%	17	37.0%	0.04	0.982	18	28.1%	28	43.8%	3.39	0.066
One-way ANOVA comparing mean immunization attitude scores																
Mean (SD)	3.38 (1.28)		3.45 (1.18)		3.26 (1.38)		3.39 (1.29)			0.794	3.41 (1.23)		3.33 (1.33)			0.731

*$p \leq 0.05$

Table 4. HPV Vaccine Attitudes

Construct	Attitude Items	Total, Frequencies (n=129) N	%	Frequencies by Study Arm: Control (n=40) N	%	Parent Only (n=42) N	%	Parent & Adolescent (n=47) N	%	χ^2	p-value	Frequencies by Gender: Female (n=64) N	%	Male (n=65) N	%	χ^2	p-value
Perceived Susceptibility	My child is very likely to get HPV																
	False	80	62.0%	28	70.0%	24	57.1%	28	59.6%			38	59.4%	42	64.6%		
	True	49	38.0%	12	30.0%	18	42.9%	19	40.4%	1.62	0.444	26	40.6%	23	35.4%	0.38	0.540
Perceived Severity	The HPV infection can cause a serious disease																
	False	11	8.7%	4	10.5%	2	4.8%	5	10.9%			5	8.9%	6	9.5%		
	True	115	91.3%	34	89.5%	40	95.2%	41	89.1%	n/a	0.531	58	92.1%	57	90.5%	0.10	0.752
Perceived Benefits	Children should be vaccinated against HPV																
	False	15	11.9%	6	15.8%	3	7.1%	6	13.0%			2	3.2%	13	20.6%		
	True	111	88.1%	32	84.2%	39	92.9%	40	87.0%	1.51	0.470	61	96.8%	50	79.4%	9.16	0.003 *
	The HPV vaccine is very effective at preventing cervical cancer																
	False	15	12.1%	7	19.4%	3	7.3%	5	10.6%			8	12.9%	7	11.3%		
	True	109	87.9%	29	80.6%	38	92.7%	42	89.4%	n/a	0.256	54	87.1%	55	88.7%	0.08	0.783
Social Norms	Most people important to me think I should give my child HPV vaccine																
	False	62	48.4%	23	59.0%	15	35.7%	24	51.1%			27	42.9%	35	53.9%		
	True	66	51.6%	16	41.0%	27	64.3%	23	48.9%	4.59	0.101	36	57.1%	30	46.2%	1.55	0.214
	Most parents I know take their child for HPV vaccine																
	False	62	48.1%	26	65.0%	16	38.1%	20	42.6%			26	40.6%	36	55.4%		
	True	67	51.9%	14	35.0%	26	61.9%	27	57.5%	6.84	0.033 *	38	59.4%	29	44.6%	2.81	0.093
One-way ANOVA comparing mean HPV vaccine attitude scores (range: 0-6)																	
	Mean (SD)	4.15 (1.42)		3.71 (1.66)		4.49 (1.42)		4.17 (1.16)			0.060	4.38 (1.26)		3.92 (1.54)			0.072

*p ≤ 0.05

Table 5a. HPV Vaccine Information Source Exposures

Have you ever heard about HPV vaccine from any of the following sources?	Total, Frequencies (n=129)		Frequencies by Study Arm								Frequencies by Gender					
			Control (n=40)		Parent Only (n=42)		Parent & Adolescent (n=47)				Female (n=64)		Male (n=65)			
	N	%	N	%	N	%	N	%	χ^2	p-value	N	%	N	%	χ^2	p-value
A doctor or medical professional?																
No	26	20.2%	13	62.5%	4	9.5%	9	19.2%			7	10.9%	19	29.2%		
Yes	103	79.8%	27	67.5%	38	90.5%	38	80.9%	6.77	0.034 *	57	89.1%	46	70.8%	6.71	0.010 *
Family or friends?																
No	68	52.7%	24	60.0%	22	52.4%	22	46.8%			31	48.4%	37	56.9%		
Yes	61	47.3%	16	40.0%	20	47.6%	25	53.2%	1.51	0.470	33	51.6%	28	43.1%	0.93	0.335
Advertisement from a drug company?																
No	42	32.6%	18	45.0%	8	19.1%	16	34.0%			21	32.8%	21	32.3%		
Yes	87	67.4%	22	55.0%	34	81.0%	31	66.0%	6.36	0.042 *	43	67.2%	44	67.7%	0.00	0.951
Internet? (non-drug ad., such as webpage or blog)																
No	74	57.4%	27	67.5%	19	45.2%	28	59.6%			37	57.8%	37	56.9%		
Yes	55	42.6%	13	32.5%	23	54.8%	19	40.4%	4.30	0.117	27	42.2%	28	43.1%	0.01	0.919
TV?																
No	33	25.6%	11	27.5%	7	16.7%	15	31.9%			15	23.4%	18	27.7%		
Yes	96	74.4%	29	72.5%	35	83.3%	32	68.1%	2.82	0.244	49	76.6%	47	72.3%	0.31	0.580
Radio?																
No	70	54.3%	26	65.0%	18	42.9%	26	55.3%			34	53.1%	36	55.4%		
Yes	59	45.7%	14	35.0%	24	57.1%	21	44.7%	4.08	0.130	30	46.9%	29	44.6%	0.06	0.797
Newspaper or magazine article?																
No	62	48.1%	23	57.5%	17	40.5%	22	46.8%			27	42.2%	35	53.9%		
Yes	67	51.9%	17	42.5%	25	59.5%	25	53.2%	2.43	0.297	37	57.8%	30	46.2%	1.76	0.185
Other?																
No	113	87.6%	36	90.0%	37	88.1%	40	85.1%			57	89.1%	56	86.2%		
Yes	16	12.4%	4	10.0%	5	11.9%	7	14.9%	0.49	0.783	7	10.9%	9	13.9%	0.25	0.616
One-way ANOVA comparing mean total number of sources (range: 0-8)																
Mean (SD)	4.2 (2.36)		3.55 (2.41)		4.86 (2.12)		4.21 (2.42)			0.042 *	4.42 (2.27)		4.01 (2.46)			0.331

*$p \leq 0.05$

Table 5b. HPV Vaccine Information Sources (continued)

	Total		Frequencies by Study Arm						Frequencies by Gender					
	(n=129)		Control (n=40)		Parent Only (n=42)		Parent & Adolescent (n=47)				Female (n=64)		Male (n=65)			
Would you rank this source among your top 2 most influential sources?	N	%	N	%	N	%	N	%	χ^2	p-value	N	%	N	%	χ^2	p-value
A doctor or medical professional?																
No	22	19.8%	6	18.8%	9	23.1%	7	17.5%			7	12.1%	15	28.3%		
Yes	89	80.2%	26	81.3%	30	76.9%	33	82.5%	0.42	0.811	51	87.9%	38	71.7%	4.59	0.032 *
Family or friends?																
No	86	77.5%	21	65.6%	32	82.1%	33	82.5%			44	75.9%	42	79.3%		
Yes	25	22.5%	11	34.4%	7	18.0%	7	17.5%	3.62	0.164	14	24.1%	11	20.8%	0.18	0.670
Advertisement from a drug company?																
No	104	93.7%	31	96.9%	36	92.3%	37	92.5%			56	96.6%	48	90.6%		
Yes	7	6.3%	1	3.1%	3	7.7%	3	7.5%	n/a	0.789	2	3.5%	5	9.4%	n/a	0.255
Internet? (non-drug ad., such as webpage or blog)																
No	99	89.2%	29	90.6%	34	87.2%	36	90.0%			54	93.1%	45	84.9%		
Yes	12	10.8%	3	9.4%	5	12.8%	4	10.0%	n/a	0.863	4	6.9%	8	15.1%	1.93	0.165
TV?																
No	78	70.3%	21	65.6%	26	66.7%	31	77.5%			42	72.4%	36	67.9%		
Yes	33	29.7%	11	34.4%	13	33.3%	9	22.5%	1.57	0.455	16	27.6%	17	32.1%	0.27	0.605
Radio?																
No	105	94.6%	31	96.9%	35	89.7%	39	97.5%			55	94.8%	50	94.3%		
Yes	6	5.4%	1	3.1%	4	10.3%	1	2.5%	n/a	0.323	3	5.2%	3	5.7%	n/a	1.000
Newspaper or magazine article?																
No	101	91.0%	30	93.8%	36	92.3%	35	87.5%			54	93.1%	47	88.7%		
Yes	10	9.0%	2	6.3%	3	7.7%	5	12.5%	n/a	0.706	4	6.9%	6	11.3%	n/a	0.515
Other?																
No	95	86.5%	29	90.6%	35	89.7%	32	80.0%			51	87.9%	45	84.9%		
Yes	15	13.5%	3	9.4%	4	10.3%	8	20.0%	2.26	0.323	7	12.1%	8	15.1%	0.22	0.641
Did hearing about HPV vaccine from any of the previously mentioned sources besides a doctor prompt you to talk to your child's doctor?																
No	45	37.2%	14	37.8%	13	32.5%	18	40.9%			24	39.3%	21	35.0%		
Yes	76	62.8%	23	62.2%	27	67.5%	26	59.1%	0.64	0.725	37	60.7%	39	65.0%	0.24	0.621
If yes, which source had the greatest impact on your decision to talk to your child's doctor about the HPV vaccine?																
TV	33	43.4%	10	43.5%	15	55.6%	8	30.8%			17	46.0%	16	41.0%		
Family/Friends	24	31.6%	10	43.5%	4	14.8%	10	38.5%			13	35.1%	11	28.2%		
Magazine/newspaper article	6	7.9%	2	8.7%	1	3.7%	3	11.5%			4	10.8%	2	5.1%		
Internet	4	5.3%	0	0.0%	4	14.8%	0	0.0%			1	2.7%	3	7.7%		
Other	4	5.3%	0	0.0%	1	3.7%	3	11.5%			2	5.4%	2	5.1%		
Advertisments from drug company	3	4.0%	0	0.0%	2	7.4%	1	3.9%			0	0.0%	3	7.7%		
Radio	2	2.6%	1	4.4%	0	0.0%	1	3.9%	n/a	n/a	0	0.0%	2	5.1%	n/a	n/a
Would you say what you've heard about HPV in the media has been mostly positive, mostly negative, or neutral?																
Mostly Positive	58	47.5%	15	40.5%	25	59.5%	18	41.9%			27	44.3%	31	50.8%		
Mostly Negative	61	50.0%	19	51.4%	17	40.5%	25	58.1%			32	52.5%	29	47.5%		
Neutral	3	2.5%	3	8.11%	0	0.00%	0	0.00%	n/a	0.059	2	3.28%	1	1.64%	n/a	0.6853

*p ≤ 0.05; n/a expected cell count too low for meaningful differences to be detected

Table 6. Health Care Provider Recommendation

	Total, Frequencies		Frequencies by Study Arm						Frequencies by Gender					
	(n=129)		Control (n=40)		Parent Only (n=42)		Parent & Adolescent (n=47)				Female (n=64)		Male (n=65)			
	N	%	N	%	N	%	N	%	χ^2	p-value	N	%	N	%	χ^2	p-value
Did a doctor ever recommend your child receive HPV vaccine?																
No	47	36.7%	15	38.5%	17	40.5%	15	31.9%			12	18.8%	35	54.7%		
Yes	81	63.3%	24	61.5%	25	59.5%	32	68.1%	0.77	0.679	52	81.3%	29	45.3%	17.79	< .0001 *

*p ≤ 0.05

Table 7. Intentions and Receipt of HPV Vaccine

	Total, Frequencies		Frequencies by Study Arm						Frequencies by Gender					
	(n=129)		Control (n=40)		Parent Only (n=42)		Parent & Adolescent (n=47)				Female (n=64)		Male (n=65)			
	N	%	N	%	N	%	N	%	χ^2	p-value	N	%	N	%	χ^2	p-value
Has your child received at least one dose of HPV vaccine?																
No	59	46.5%	15	38.5%	22	53.7%	22	46.8%			18	28.1%	41	65.1%		
Yes	68	53.5%	24	61.5%	19	46.3%	25	53.2%	1.86	0.395	46	71.9%	22	34.9%	17.43	< .0001 *
Has your child received all three doses of HPV vaccine?																
No	37	54.4%	13	54.2%	13	65.0%	11	45.8%			21	45.7%	16	72.6%		
Yes	31	45.6%	11	45.8%	7	35.0%	13	54.2%	1.62	0.446	25	54.4%	6	27.3%	4.40	0.036 *
Do you ever plan to have your child receive the HPV vaccine?																
No	14	24.1%	7	46.7%	5	22.7%	2	9.5%			1	5.9%	13	31.7%		
Yes	44	75.9%	8	53.3%	17	77.3%	19	90.5%	6.63	0.036 *	16	94.1%	28	68.3%	n/a	0.046 *

*p ≤ 0.05

Table 8. Facilitators Related to HPV Vaccine Uptake or Intention

Subset sample, those received at least one dose of HPV vaccine or intended to in the future (n=113)

	Subset total		Frequencies by Study Arm						Frequencies by Gender					
			Control		Parent Only		Parent & Adolescent				Female		Male			
	(n=113)		(n=32)		(n=37)		(n=44)				(n=62)		(n=51)			
	N	%	N	%	N	%	N	%	χ^2	p-value	N	%	N	%	χ^2	p-value
Which of the following influenced your decision to get your child vaccinated or plan to get them vaccinated with HPV vaccine?																
I heard about it on the news																
No	70	62.0%	23	71.9%	19	51.4%	28	63.6%			41	66.1%	29	56.9%		
Yes	43	38.1%	9	28.1%	18	48.7%	16	36.4%	3.15	0.207	21	33.9%	22	43.1%	1.02	0.313
It was recommended by a friend/family member																
No	70	62.0%	23	71.9%	21	56.8%	26	59.1%			38	61.3%	32	62.8%		
Yes	43	38.1%	9	28.1%	16	43.2%	18	40.9%	3.15	0.207	24	38.7%	19	37.3%	0.03	0.874
Our family doctor recommended it for my child																
No	11	9.7%	3	9.4%	3	8.1%	5	11.4%			6	9.7%	5	9.8%		
Yes	102	90.3%	29	90.6%	34	91.9%	39	88.6%	n/a	0.924	56	90.3%	46	90.2%	n/a	1.000
It was recommended by the health department																
No	70	62.0%	26	81.3%	20	54.1%	24	54.6%			46	74.2%	24	47.1%		
Yes	43	38.1%	6	18.8%	17	46.0%	20	45.5%	7.06	0.029 *	16	25.8%	27	52.9%	8.74	0.003 ****
Other reasons																
No	85	75.2%	25	78.1%	27	73.0%	33	75.0%			42	67.7%	43	84.3%		
Yes	28	24.8%	7	21.9%	10	27.0%	11	25.0%	0.25	0.884	20	32.3%	8	15.7%	4.12	0.042 *
	"Other reasons" included: family member affected, perception that the vaccine is important & necessary, desire to prevent cervical cancer															
If HPV vaccine was available at your child's school would you allow them to be vaccinated?																
No	45	35.2%	16	41.0%	14	33.3%	15	31.9%			23	35.9%	22	34.4%		
Yes	83	64.8%	23	59.0%	28	66.7%	32	68.1%	0.87	0.648	41	64.1%	42	65.6%	0.03	0.853

*p ≤ 0.05

Table 9. Barriers Related to HPV Vaccine Non-Receipt

Subset sample, those who did not receive at least one dose of HPV vaccine and did not intend to in the future (n=15)

Which of the following influenced your decision not have your child vaccinated with HPV vaccine?

I was concerned about side effects from the vaccine				I was concerned it would make my child sick		
	No	5	33.3%	No	9	60.0%
	Yes	10	66.7%	Yes	6	40.0%
	Unknown	0	0.0%	Unknown	0	0.0%
My child did not need it				My child is scared of needles		
	No	4	26.7%	No	12	80.0%
	Yes	11	73.3%	Yes	3	20.0%
	Unknown	0	0.0%	Unknown	0	0.0%
My doctor did not recommend HPV vaccine for my child				No appointment times available		
	No	6	40.0%	No	15	100.0%
	Yes	9	60.0%	Yes	0	0.0%
	Unknown	0	0.0%	Unknown	0	0.0%
It is hard to get HPV vaccine				HPV vaccination may increase sexual activity		
	No	14	93.3%	No	14	93.3%
	Yes	0	0.0%	Yes	1	6.7%
	Unknown	1	6.7%	Unknown	0	0.0%
Hard to find time to fit it in				My child is too young to get it		
	No	15	100.0%	No	14	93.3%
	Yes	0	0.0%	Yes	1	6.7%
	Unknown	0	0.0%	Unknown	0	0.0%
The vaccine costs too much				Other		
	No	11	73.3%	No	8	53.3%
	Yes	3	20.0%	Yes	7	46.7%
	Unknown	1	6.7%	Unknown	0	0.0%

"Other reasons" included: not sure what HPV is, didn't know much/anything about the vaccinemental capacity limited since her son has autism, son will get HPV anyway and it is viral, not sure if son needs the vaccine

Table 10a. Bivariate Association Between Provider Recomendation & HPV Vaccine Uptake

	Receipt of HPV Vaccine (at least one dose)																	
	Overall						Females						Males					
	No		Yes			p-	No		Yes			p-	No		Yes			p-
	n	%	n	%	χ^2	value	n	%	n	%	χ^2	value	n	%	n	%	χ^2	value
Did a doctor recommend your child receive HPV vaccine?																		
No	39	**66.1**	7	**10.3**			9	**50.0**	3	**6.5**			30	**73.2**	4	**18.2**		
Yes	20	**33.9**	61	**89.7**	42.59	< 0.0001 *	9	**50.0**	43	**93.5**	n/a	0.0001 *	11	**26.8**	18	**81.8**	17.43	< 0.0001 *

*p ≤ 0.05

Table 10b. Bivariate Association Between Provider Recomendation & HPV Vaccine Intention

	Intention to Receive HPV Vaccine																	
	Overall						Females						Males					
	No		Yes			p-	No		Yes			p-	No		Yes			p-
	n	%	n	%	χ^2	value	n	%	n	%	χ^2	value	n	%	n	%	χ^2	value
Did a doctor recommend your child receive HPV vaccine?	12	**85.7**	26	**59.1**			0	**0.0**	8	**50.0**			12	**92.3**	18	**64.3**		
No	2	**14.3**	18	**40.9**	n/a	0.0679	1	**100.0**	8	**50.0**	n/a	1	1	**7.7**	10	**35.7**	n/a	0.1267
Yes																		

*p ≤ 0.05

Table 11a. Bivariate Associations betweenAttitudes & HPV Vaccine Uptake

	Receipt of HPV Vaccine (at least one dose)																	
	Overall						Females						Males					
	No		Yes			p-	No		Yes			p-	No		Yes			p-
	n	%	n	%	χ^2	value	n	%	n	%	χ^2	value	n	%	n	%	χ^2	value
Perceived Susceptibility																		
My child is very likely to get HPV																		
False	42	**71.2**	36	**52.9**			13	**72.2**	25	**54.3**			29	**70.7**	11	**50.0**		
True	17	**28.8**	32	**47.1**	4.44	0.035 *	5	**27.8**	21	**45.7**	1.71	0.191	12	**29.3**	11	**50.0**	2.65	0.103
Perceived Severity																		
The HPV infection can cause a serious disease																		
False	6	**10.7**	4	**5.9**			3	**17.6**	2	**4.3**			3	**7.7**	2	**9.1**		
True	50	**89.3**	64	**94.1**	n/a	0.345	14	**82.4**	44	**95.7**	n/a	0.117	36	**92.3**	20	**90.9**	n/a	1.000
Perceived Benefits																		
Children should be vaccinated against HPV																		
False	12	**21.4**	2	**4.2**			1	**5.9**	1	**2.2**			11	**28.2**	1	**4.5**		
True	44	**78.6**	46	**95.8**	10.48	0.001 *	16	**94.1**	45	**97.8**	n/a	0.470	28	**71.8**	21	**95.5**	n/a	0.041 *
The HPV vaccine is very effective at preventing cervical cancer																		
False	10	**17.9**	5	**7.6**			3	**16.7**	5	**11.4**			7	**18.4**	0	**0.0**		
True	46	**82.1**	61	**92.4**	2.97	0.085	15	**83.3**	39	**88.6**	n/a	0.681	31	**81.6**	22	**100.0**	n/a	0.041 *
Social Norms																		
Most people important to me think I should give my child HPV vaccine																		
False	38	**64.4**	23	**34.3**			10	**55.6**	17	**37.8**			28	**68.3**	6	**27.3**		
True	21	**35.6**	44	**65.7**	11.37	0.001 *	8	**44.4**	28	**62.2**	1.66	0.198	13	**31.7**	16	**72.7**	9.70	0.002 *
Most parents I know take their child for HPV																		
False	32	**54.2**	28	**41.2**			10	**55.6**	16	**34.8**			22	**53.7**	12	**54.5**		
True	27	**45.8**	40	**58.8**	2.16	0.141	8	**44.4**	30	**65.2**	2.31	0.128	19	**46.3**	10	**45.5**	0.0	0.946
Two-sample t-test comparing mean HPV vaccine attitude scores (range: 0-6)																		
Mean	3.71		4.57				3.88		4.58				3.63		4.54			
(SD)	(1.66)		(1.00)			0.001 *	(1.62)		(1.05)			0.113	(1.7)		(0.91)			0.009 *

*p ≤ 0.05

Table 11b. Bivariate Associations betweenAttitudes & HPV Vaccine Intention

	Intention to Receive HPV Vaccine															
	Overall						Females						Males			
	No		Yes			p-	No		Yes			p-	No		Yes			p-
	n	%	n	%	χ^2	value	n	%	n	%	χ^2	value	n	%	n	%	χ^2	value
Perceived Susceptibility																		
My child is very likely to get HPV																		
False	14	**100.0**	27	**61.4**			1	**100.0**	11	**68.8**			13	**100.0**	16	**57.1**		
True	0	**0.0**	17	**38.6**	n/a	0.006 *	0	**0.0**	5	**31.3**	n/a	1	0	**0.0**	12	**42.9**	n/a	0.008 *
Perceived Severity																		
The HPV infection can cause a serious disease																		
False	3	**25.0**	2	**4.7**			1	**100.0**	1	**6.7**			2	**18.2**	1	**3.6**		
True	9	**75.0**	41	**95.3**	n/a	0.064	0	**0.0**	14	**93.3**	n/a	0.125	9	**81.8**	27	**96.4**	n/a	0.187
Perceived Benefits																		
Children should be vaccinated against HPV																		
False	7	**58.3**	5	**11.6**			0	**0.0**	1	**6.7**			7	**63.6**	4	**14.3**		
True	5	**41.7**	38	**88.4**	n/a	0.002 *	1	**100.0**	14	**93.3**	n/a	1	4	**36.4**	24	**85.7**	n/a	0.004 *
The HPV vaccine is very effective at preventing cervical cancer																		
False	5	**45.5**	5	**11.4**			1	**100.0**	2	**12.5**			4	**40.0**	3	**10.7**		
True	6	**54.5**	39	**88.6**	n/a	0.020 *	0	**0.0**	14	**87.5**	n/a	0.177	6	**60.0**	25	**89.3**	n/a	0.063
Social Norms																		
Most people important to me think I should give my child HPV vaccine																		
False	12	**85.7**	25	**56.8**			1	**100.0**	8	**50.0**			11	**84.6**	17	**60.7**		
True	2	**14.3**	19	**43.2**	3.8	0.050 *	0	**0.0**	8	**50.0**	n/a	1	2	**15.4**	11	**39.3**	n/a	0.164
Most parents I know take their child for HPV																		
False	12	**85.7**	20	**45.5**			1	**100.0**	9	**56.3**			11	**84.6**	11	**39.3**		
True	2	**14.3**	24	**54.5**	7.0	0.008 *	0	**0.0**	7	**43.8**	n/a	1	2	**15.4**	17	**60.7**	7.3	0.007 *
Two-sample t-test comparing mean HPV vaccine attitude scores (range: 0-6)																		
Mean	2.09		4.14										2.30		4.14			
(SD)	(1.64)		(1.42)			0.0001 *	1		4.133			n/a	(1.69)		(1.41)			0.001 *

*p ≤ 0.05

Table 12a. Bivariate Association between Sources of Information Sources & HPV Vaccine Uptake

	Receipt of HPV Vaccine (at least one dose)															
	Overall						Females						Males			
	No		Yes			p-	No		Yes			p-	No		Yes			p-
	n	%	n	%	χ^2	value	n	%	n	%	χ^2	value	n	%	n	%	χ^2	value
Have you ever heard about HPV vaccine from any of the following sources?																		
A doctor or medical professional?																		
No	21	**35.6**	5	**7.4**			3	**16.7**	4	**8.7**			18	**43.9**	1	**4.5**		
Yes	38	**64.4**	63	**92.6**	15.47	< 0.0001 *	15	**83.3**	42	**91.3**	n/a	0.391	23	**56.1**	21	**95.5**	10.53	0.001 *
Family or friends?																		
No	32	**54.2**	35	**51.5**			9	**50.0**	22	**47.8**			23	**56.1**	13	**59.1**		
Yes	27	**45.8**	33	**48.5**	0.10	0.755	9	**50.0**	24	**52.2**	0.02	0.876	18	**43.9**	9	**40.9**	0.05	0.819
Advertisement from a drug company?																		
No	22	**37.3**	19	**27.9**			7	**38.9**	14	**30.4**			15	**36.6**	5	**22.7**		
Yes	37	**62.7**	49	**72.1**	1.26	0.261	11	**61.1**	32	**69.6**	0.42	0.517	26	**63.4**	17	**77.3**	1.27	0.26
Internet? (non-drug ad., such as webpage or blog)																		
No	35	**58.3**	38	**55.9**			10	**55.6**	27	**58.7**			24	**68.6**	11	**50.0**		
Yes	25	**41.7**	30	**44.1**	0.04	0.843	8	**44.4**	19	**41.3**	0.05	0.819	11	**31.4**	11	**50.0**	0.42	0.516
TV?																		
No	21	**35.6**	11	**16.2**			6	**33.3**	9	**19.6**			15	**36.6**	2	**9.1**		
Yes	38	**64.4**	57	**83.8**	6.32	0.012 *	12	**66.7**	37	**80.4**	n/a	0.326	26	**63.4**	20	**90.9**	5.49	0.019 *
Radio?																		
No	38	**64.4**	31	**45.6**			13	**72.2**	21	**45.7**			25	**61.0**	10	**45.5**		
Yes	21	**35.6**	37	**54.4**	4.51	0.034 *	5	**27.8**	25	**54.3**	3.67	0.056 *	16	**39.0**	12	**54.5**	1.40	0.237
Newspaper or magazine article?																		
No	32	**54.2**	29	**42.6**			7	**38.9**	20	**43.5**			25	**61.0**	9	**40.9**		
Yes	27	**45.8**	39	**57.4**	1.70	0.192	11	**61.1**	26	**56.5**	0.11	0.738	16	**39.0**	13	**59.1**	2.32	0.128
Other?																		
No	52	**88.1**	59	**86.8**			16	**88.9**	41	**89.1**			36	**87.8**	18	**81.8**		
Yes	7	**11.9**	9	**13.2**	0.05	0.816	2	**11.1**	5	**10.9**	n/a	1	5	**12.2**	4	**18.2**	0.42	0.517
Two-sample t-test comparing mean total number of sources (range: 0-8)																		
Mean (SD)	3.73 (2.50)		4.66 (2.15)			0.0258 *	4.05 (2.58)		4.56 (2.15)			0.423	3.58 (2.49)		4.86 (2.21)			0.048 *

*p ≤ 0.05

Table 12b. Bivariate Association between Sources of Information Sources & HPV Vaccine Intention

	Intention to Receive HPV Vaccine															
	Overall						Females						Males			
	No		Yes			p-	No		Yes			p-	No		Yes			p-
	n	%	n	%	χ^2	value	n	%	n	%	χ^2	value	n	%	n	%	χ^2	value
Have you ever heard about HPV vaccine from any of the following sources?																		
A doctor or medical professional?																		
No	10	**71.4**	10	**22.7**			0	**0**	2	**12.5**			10	**76.9**	8	**28.6**		
Yes	4	**28.6**	34	**77.3**	n/a	0.002 *	1	**100**	14	**87.5**	n/a	1.000	3	**23.1**	20	**71.4**	8.43	0.004 *
Family or friends?																		
No	13	**92.9**	18	**40.9**			1	**100**	7	**43.75**			12	**92.3**	11	**39.3**		
Yes	1	**7.1**	26	**59.1**	11.52	0.001 *	0	**0**	9	**56.25**	n/a	0.471	1	**7.7**	17	**60.7**	10.13	0.002 *
Advertisement from a drug company?																		
No	7	**50.0**	14	**31.8**			1	**100**	5	**31.25**			6	**46.2**	9	**32.1**		
Yes	7	**50.0**	30	**68.2**	1.52	0.218	0	**0**	11	**68.75**	n/a	0.353	7	**53.8**	19	**67.9**	n/a	0.492
Internet? (non-drug ad., such as webpage or blog)																		
No	9	**64.3**	24	**54.5**			0	**0**	9	**56.25**			9	**69.2**	15	**53.6**		
Yes	5	**35.7**	20	**45.5**	0.41	0.522	1	**100**	7	**43.75**	n/a	0.471	4	**30.8**	13	**46.4**	0.90	0.344
TV?																		
No	5	**35.7**	15	**34.1**			0	**0**	5	**31.25**			5	**38.5**	10	**35.7**		
Yes	9	**64.3**	29	**65.9**	n/a	1	1	**100**	11	**68.75**	n/a	1	8	**61.5**	18	**64.3**	n/a	1
Radio?																		
No	8	**57.1**	29	**65.9**			1	**100**	11	**68.75**			7	**53.8**	18	**64.3**		
Yes	6	**42.9**	15	**34.1**	0.35	0.552	0	**0**	5	**31.25**	n/a	1	6	**46.2**	10	**35.7**	0.41	0.524
Newspaper or magazine article?																		
No	8	**57.1**	23	**52.3**			0	**0**	6	**37.5**			8	**61.5**	17	**60.7**		
Yes	6	**42.9**	21	**47.7**	0.10	0.750	1	**100**	10	**62.5**	n/a	1	5	**38.5**	11	**39.3**	0.00	0.960
Other?																		
No	14	**100.0**	37	**84.1**			1	**100**	14	**87.5**			13	**100.0**	23	**82.1**		
Yes	0	**0.0**	7	**15.9**	n/a	0.178	0	**0**	2	**12.5**	n/a	1	0	**0.0**	5	**17.9**	n/a	0.160
Two-sample t-test comparing mean total number of sources (range: 0-8)																		
Mean (SD)	2.71 (1.4)		4.14 (3.39)			0.0606	4.00 (n=1)		4.31 (2.52)			n/a	2.61 (2.33)		4.04 (2.47)			0.089

*$p \leq 0.05$

Table 12c. Bivariate Association between Valued Sources of Information Sources & HPV Vaccine Uptake

	Receipt of HPV Vaccine (at least one dose)																	
	Overall						Females						Males					
	No		Yes			p-	No		Yes			p-	No		s			p-
	n	%	n	%	χ^2	value	n	%	n	%	χ^2	value	n	%	n	%	χ^2	value
Would you rank this source among your top 2 most influential sources?																		
Doctor or medical professional?																		
No	16	**34.8**	6	**9.5**			3	**20.0**	4	**9.3**			13	**41.9**	2	**10.0**		
Yes	30	**65.2**	57	**90.5**	10.53	0.001 *	12	**80.0**	39	**90.7**	n/a	0.360	18	**58.1**	18	**90.0**	5.97	0.015 *
Family or friends?																		
No	34	**73.9**	50	**79.4**			12	**80.0**	32	**74.4**			22	**71.0**	18	**90.0**		
Yes	12	**26.1**	13	**20.6**	0.45	0.504	3	**20.0**	11	**25.6**	n/a	1	9	**29.0**	2	**10.0**	n/a	0.166
Advertisement from a drug company?																		
No	40	**87.0**	62	**98.4**			14	**93.3**	42	**97.7**			26	**83.9**	12	**100.0**		
Yes	6	**13.0**	1	**1.6**	n/a	0.040 *	1	**6.7**	1	**2.3**	n/a	0.454	5	**16.1**	0	**0.0**	n/a	0.143
Internet? (non-drug ad., such as webpage or blog)																		
No	40	**87.0**	57	**90.5**			14	**93.3**	40	**93.0**			26	**83.9**	17	**85.0**		
Yes	6	**13.0**	6	**9.5**	0.34	0.562	1	**6.7**	3	**7.0**	n/a	1	5	**16.1**	3	**15.0**	n/a	1
TV?																		
No	36	**78.3**	40	**63.5**			13	**86.7**	29	**67.4**			23	**74.2**	11	**55.0**		
Yes	10	**21.7**	23	**36.5**	2.75	0.097	2	**13.3**	14	**32.6**	n/a	0.194	8	**25.8**	9	**45.0**	2.02	0.156
Radio?																		
No	40	**87.0**	63	**100.0**			12	**80.0**	43	**100.0**			28	**90.3**	20	**100.0**		
Yes	6	**13.0**	0	**0.0**	n/a	0.005 *	3	**20.0**	0	**0.0**	n/a	0.015 *	3	**9.7**	0	**0.0**	n/a	0.271
Newspaper or magazine article?																		
No	43	**93.5**	57	**90.5**			14	**93.3**	40	**93.0**			29	**93.5**	17	**85.0**		
Yes	3	**6.5**	6	**9.5**	n/a	0.731	1	**6.7**	3	**7.0**	n/a	1	2	**6.5**	3	**15.0**	n/a	0.369
Other?																		
No	37	**80.4**	57	**90.5**			12	**80.0**	39	**90.7**			25	**80.6**	18	**90.0**		
Yes	9	**19.6**	6	**9.5**	2.26	0.133	3	**20.0**	4	**9.3**	n/a	0.360	6	**19.4**	2	**10.0**	n/a	0.456
Did hearing about HPV vaccine from any of the previously mentioned sources besides a doctor prompt you to talk to your child's doctor?																		
No	25	**46.3**	20	**30.8**			8	**50.0**	16	**35.6**			17	**44.7**	4	**20.0**		
Yes	29	**53.7**	45	**69.2**	3.024	0.082	8	**50.0**	29	**64.4**	1	0.31	21	**55.3**	16	**80.0**	3.471	0.0624

*$p \leq 0.05$

Table 12d. Bivariate Association between Valued Sources of Information Sources & HPV Vaccine Intention

	Intention to Receive HPV Vaccine																	
	Overall						Females						Males					
	No		Yes			p-	No		Yes			p-	No		s			p-
	n	%	n	%	χ^2	value	n	%	n	%	χ^2	value	n	%	n	%	χ^2	value
Would you rank this source among your top 2 most influential sources?																		
A doctor or medical professional?																		
No	3	**50.0**	13	**32.5**			0	**0.0**	3	**21.4**			3	**60.0**	10	**38.5**	n/a	0.625
Yes	3	**50.0**	27	**67.5**	n/a	0.406	1	**100.0**	11	**78.6**	n/a	1	2	**40.0**	16	**61.5**		
Family or friends?																		
No	6	**100.0**	28	**70.0**			1	**100.0**	11	**78.6**			5	**100.0**	17	**65.4**	n/a	0.286
Yes	0	**0.0**	12	**30.0**	n/a	0.317	0	**0.0**	3	**21.4**	n/a	1	0	**0.0**	9	**34.6**		
Advertisement from a drug company?																		
No	4	**66.7**	36	**90.0**			1	**100.0**	13	**92.9**			3	**60.0**	23	**88.5**	n/a	0.173
Yes	2	**33.3**	4	**10.0**	n/a	0.169	0	**0.0**	1	**7.1**	n/a	1	2	**40.0**	3	**11.5**		
Internet? (non-drug ad., such as webpage or blog)																		
No	5	**83.3**	35	**87.5**			1	**100.0**	13	**92.9**			4	**80.0**	22	**84.6**	n/a	1
Yes	1	**16.7**	5	**12.5**	n/a	1	0	**0.0**	1	**7.1**	n/a	1	1	**20.0**	4	**15.4**		
TV?																		
No	2	**33.3**	34	**85.0**			0	**0.0**	13	**92.9**			2	**40.0**	21	**80.8**	n/a	0.093
Yes	4	**66.7**	6	**15.0**	n/a	0.015 *	1	**100.0**	1	**7.1**	n/a	0.133	3	**60.0**	5	**19.2**		
Radio?																		
No	6	**100.0**	34	**85.0**			1	**100.0**	11	**78.6**			5	**100.0**	23	**88.5**	n/a	1
Yes	0	**0.0**	6	**15.0**	n/a	0.579	0	**0.0**	3	**21.4**	n/a	1	0	**0.0**	3	**11.5**		
Newspaper or magazine article?																		
No	5	**83.3**	38	**95.0**			1	**100.0**	13	**92.9**			4	**80.0**	25	**96.2**	n/a	0.301
Yes	1	**16.7**	2	**5.0**	n/a	0.349	0	**0.0**	1	**7.1**	n/a	1	1	**20.0**	1	**3.8**		
Other?																		
No	6	**100.0**	31	**77.5**			1	**100.0**	11	**78.6**			5	**100.0**	20	**76.9**		
Yes	0	**0.0**	9	**22.5**	n/a	0.327	0	**0.0**	3	**21.4**	n/a	1	0	**0.0**	6	**23.1**	n/a	0.553
Did hearing about HPV vaccine from any of the previously mentioned sources besides a doctor prompt you to talk to your child's doctor?																		
No	8	**72.7**	16	**38.1**			1	**100.0**	6	**42.9**			7	**70.0**	10	**35.7**	n/a	0.078
Yes	3	**27.3**	26	**61.9**	n/a	0.05 *	0	**0.0**	8	**57.1**	n/a	0.467	3	**30.0**	18	**64.3**		

*$p \leq 0.05$