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Explaining HPV vaccine uptake among African American adolescent females using The Diffusion of Innovations Theory

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By

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B.A. Latin American Studies and Hispanic Linguistics
University of North Carolina at Chapel Hill
2012

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Abstract

Explaining HPV vaccine uptake among African American adolescent females using The Diffusion of Innovations Theory

By Julia Evan Still

Human Papillomavirus (HPV) prevalence among African American adolescents is disproportionately high in comparison with other age and ethnic groups. HPV vaccination series initiation and completion rates remain low among this population, despite the availability of a safe and effective vaccine. Previous theoretical frameworks have been unable to successfully integrate all factors involved in HPV vaccine uptake. Innovative theoretically grounded strategies are needed to enhance overall understanding and intervention design for those at highest risk of infection. This purpose of this research was to examine correlates of HPV and cancer knowledge and intent to vaccinate against HPV among African American adolescent females using Everett Rogers' Diffusion of Innovations Theory [1]. This research tested the explanatory power of the DOI Innovation-Decision Process model and the DOI model for preventative innovations as applied to HPV vaccine decision-making. Using ACASI, 216 surveys were completed with African American females 14-18 years of age. The items measured in the ACASI were mapped to the DOI Innovation-Decision Process model. A cross-sectional analysis was conducted to examine correlates of HPV knowledge and intention to vaccinate against HPV within the context of DOI. While DOI has never been used to explain HPV vaccine decision-making, application of this model accounts for all variables that influence HPV vaccine uptake. The results of this research demonstrate that DOI is an appropriate model to conceptualize and analyze HPV vaccine decision-making. The DOI Innovation-Decision Process model successfully integrates all correlates of HPV vaccination and provides an optimal framework through which to explain HPV knowledge and intent to vaccinate among African American adolescent females. Subsequent research must be conducted to test the application of DOI to predict HPV vaccine series initiation and completion among African American adolescents. DOI should be used to frame future HPV vaccine uptake intervention strategies to increase the diffusion of the vaccine among this at-risk population.

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INTRODUCTION

Human Papillomavirus

The genital human papillomavirus (HPV) is the most common sexually transmitted infection (STI). HPV is transmitted through genital contact, primarily during vaginal and anal sex. The virus can also be passed during oral sex or genital-to-genital contact. The group of viruses consists of more than 150 different strains. Of these HPV strains, 40 strains can be transmitted through sexual contact, infecting the genital areas of males and females, as well as the mouth and throat [2].

Most sexually active men and women will contract HPV at some point in their lives. For 90% of infected individuals, the body's immune system removes HPV naturally within 2 years. However, about 10% of HPV infected individuals remain infected. There is no treatment for the virus itself [2].

Among individuals who remain infected, HPV can cause serious health problems including genital warts, recurrent respiratory papillomatosis, and cancers of the cervix, vulva, vagina, penis, anus, and back of the throat. HPV strains are classified by their oncogenic potential with high-risk types causing cancers [2]. Between 2004 and 2008 in the United States, an estimated 33,369 HPV associated cancers were diagnosed annually: 21,290 among females and 12,080 among males [3]. Cervical cancer is the most common of HPV associated cancers, followed by oropharyngeal cancer [3]. Recent United States population based studies show that 66% of cervical cancers, 55% of vaginal cancers, 79% of anal cancers, and 62% of oropharayngeal cancers are due to two high-risk HPV types, 16 and 18 [2].

HPV Epidemiology

HPV is a serious public health threat. As of 2013, approximately 79 million people in the United States are infected with HPV [2]. About 14 million males and females will become newly infected each year [2].

Like other STIs, rates of HPV are higher in adolescent populations. Adolescents are at a greater risk for contracting HPV. Over 80% of sexually active women are exposed to the virus within 3 to 4 years after becoming sexually active [4]. Due to the fact that most females in the United States initiate sexual activity in their adolescence, HPV is of particular concern in the adolescent female population. Most prevalence rates show that HPV rates are six to eight times higher in younger women compared to older women [4]. While prevalence rates among female adolescents vary, one study reported an overall HPV prevalence of 19.5% among adolescent females 14-17 years of age [5]. Another study found that almost 25% of 14-19 year olds are infected with HPV [6]. Further, a longitudinal study reported that approximately 55% of adolescents acquired HPV within 36 months after joining the study, about 5-7 years after becoming sexually active [4] .

Research consistently shows that among the adolescent female population, the highest prevalence of HPV is among low-income and minority women [6 7]. HPV prevalence is highest among African American female adolescents. One study reported that in a sample of predominantly African American adolescents 13-18 years of age, 70.7% of females were infected with HPV [8]. Another study in Atlanta, Georgia observed a prevalence rate of 64% among a sample of predominantly African American adolescents 12-19 years of age [9]. Further, 77% of the sample had at least 1 high risk HPV type [9]. A longitudinal study conducted with a sample of 85% African American adolescent females, 14-17 years of age,

reported an HPV prevalence ranging from 25-40%, with a cumulative prevalence of 81.7% [10]. Consistent with other studies, 55% of the adolescents who were HPV negative acquired an HPV infection within a 3-year period [10]. In effect, epidemiological research demonstrates that HPV prevalence is dramatically higher for African American adolescents than any other age group or population. Prevention strategies directed at African American adolescents are necessary.

Risk Factors

A number of factors have been associated with HPV infection among women. Studies have consistently found that HPV infection is associated with young age and most common among women younger than 25 years [5 4]. HPV prevalence rates are observed to be higher among women a few years after they become sexually active [7]. Additionally, adolescents are found to be biologically more vulnerable to HPV infection than adult women [5 4]. Other risk factors that have been identified through research include: being single, having an African American partner, combining sex and alcohol, greater number of sexual partners, and a history of STIs [7 11 12].

In a study of predominantly African American adolescent women in Atlanta, Georgia, HPV infection was associated with a greater number of lifetime sexual partners, older male sex partners, frequent sexual activity during the past three months, and substance use [7]. Additionally, research has found that among African American adolescent girls, HPV infection was associated with lower condom use, co-infection with other STIs, and multiple sex partners [10 12]. As such, economically disenfranchised African American girls seeking treatment for STIs are an underserved population at increased risk for HPV infection. Given

the risk for HPV infection among this subgroup and the adverse health consequences associated with HPV infection, enhancing HPV prevention is a public health priority.

HPV Prevention

In the United States, prevention of HPV and associated cancers includes both primary and secondary prevention methods. Transmission of HPV can be reduced through condom use and limiting the number of sexual partners. Cancers caused by HPV, such as cervical cancer, can be reduced through cervical cancer screening. The principal HPV prevention approach is the HPV vaccination [2].

While there is no treatment for HPV, the HPV vaccine protects individuals from contracting the virus. Two HPV vaccines have been developed and approved by the U.S. Food and Drug Administration (FDA) to protect against high risk HPV types that cause cancers: Cervarix, a bivalent vaccine, and Gardasil, a quadrivalent vaccine [13 14 15]. Both vaccines protects against HPV types 16 and 18, the types that cause most cervical, anogential and oroparyngeal cancers [16]. The Gardasil vaccine also protects against HPV types 6 and 11.

The Gardasil HPV prophylactic vaccine is an effective innovation licensed in 2006 for preventing HPV infection in males and females. This vaccine protects against two types of HPV that cause 90% of genital warts and two types of HPV that cause 70% of cervical cancers [14 15]. The vaccine is given in three shots overs six months. The CDC notes that it is important to receive all three doses of the vaccine series for the best protection against HPV [3]

Currently, the Advisory Committee on Immunization Practices (ACIP) recommends that all males up to 21 years of age and females up to 26 years of age, regardless of sexual practices, receive the complete three dose series of the vaccination [15 17]. The vaccine is

recommended for 11 or 12 year old boys and girls specifically. This is due to the fact that boys and girls ages 11 or 12 are most likely to have the best protection provided by the HPV vaccine, are not yet sexually active, and have a higher immune response [2].

HPV Vaccine Efficacy and Safety

It is important to note that both efficacy and safety studies on the HPV vaccine have confirmed that the three dose series of the Cervarix and Gardasil vaccines are in fact safe and effective for both males and females [3]. Efficacy studies have shown that the HPV vaccine is 95-100% effective in preventing vaccine-type HPV infection [18]. However, data on long-term efficacy of the vaccines is limited due to the fact that the vaccine is relatively new. The longest running study, with follow up data up to 8.5 years after vaccination, reported a vaccine efficacy of 100% [18].

In the United States, federal agencies and vaccine manufacturers have independently conducted vaccine safety monitoring and evaluation, both before and after the vaccine was licensed [3]. Prelicensure clinical trials demonstrated both safety and efficacy among thousands of patients [3]. Also, three population based published studies of the quadrivalent HPV vaccine, Gardasil, have been conducted. Monitoring and evaluation has shown that syncope is the most common adverse event associated with vaccination. As a result, the ACIP recommends that clinicians observe patients for 15 minutes after vaccination [3]. No serious safety concerns have been identified in the post licensure studies of the HPV vaccine [3].

HPV Vaccine Uptake

Despite a safe and effective vaccine to protect against HPV, vaccination rates are very low, particularly among adolescents. Research shows that the ACIP Guidelines for HPV

vaccination are not sufficient to enhance vaccination rates, especially among populations that are most vulnerable to HPV infection, like African American adolescents. Data from the 2006-2011 National Immunization Survey (NIS) for Teens shows that of adolescent females 13-17 in the United States, just 53% received one or more doses of the HPV vaccine. Further, only 34.8% of adolescents had completed all three required vaccine doses [19]. The data from the 2007-2012 NIS for Teens shows that for the first time since the vaccine was approved, there was no increase in series initiation and series completion rates among adolescent females in the United States [3].

In addition to poor HPV vaccination rates overall in the United States, data shows that there are significant racial and socio-economic disparities in HPV vaccine initiation and series completion [20 14 15 21 22 23]. Overall, African American adolescents are less likely than whites to initiate and complete the HPV vaccine series [20 14 24 22]. The 2011 NIS for Teens reported that 56.0% of African American adolescents initiated the vaccine and only 31.7% completed the vaccine series. Series completion among African American adolescent females is lower than both whites (33.0%) and Hispanics (41.6%) [19]. This disparity is a serious public health concern due to the fact that African American females are more likely to become infected with HPV, more likely to get cervical cancer, and more likely to die from cervical cancer [13] Given such evidence, focused vaccination efforts on minority adolescents could reduce racial disparities in cervical cancer incidence being that cervical cancer is most prevalent among minority women [13].

In addition to the racial and ethnic disparities present in HPV vaccine uptake in the United States, considerable geographic disparities also exist. The 2011 NIS for Teens data demonstrates that the southeastern United States has lower series initiation and series

completion rates among adolescents than other geographic regions [19]. In the southern census region, only 30.6% of adolescent females 13-17 have received all three doses of the HPV vaccine, in comparison to 39.9% in the Northeast, 33.5% in the Midwest, and 38.7% in the West [19]. This geographic disparity is particularly problematic due to the fact that HPV and HPV related cancer incidence is also higher in the southeast. In Georgia, the state in which this study takes place, 48.4% of adolescent females have initiated the series while only 30.0% have completed the series [19]. From this data, it is evident that series initiation and completion rates are substantially lower in Georgia than in other geographic regions as well as the Unites States overall. In effect, HPV vaccine promotion strategies should seek to address such racial and geographic disparities in HPV vaccination series initiation and completion.

Although the HPV vaccine is demonstrated to be highly effective and safe, vaccination rates are poor, especially among southern African American adolescent females who are at significant risk for contracting HPV. New and innovative theoretically grounded strategies are needed to enhance overall understanding of HPV vaccine decision-making and intervention design for African American adolescent uptake of the HPV vaccination.

Theoretical Foundation

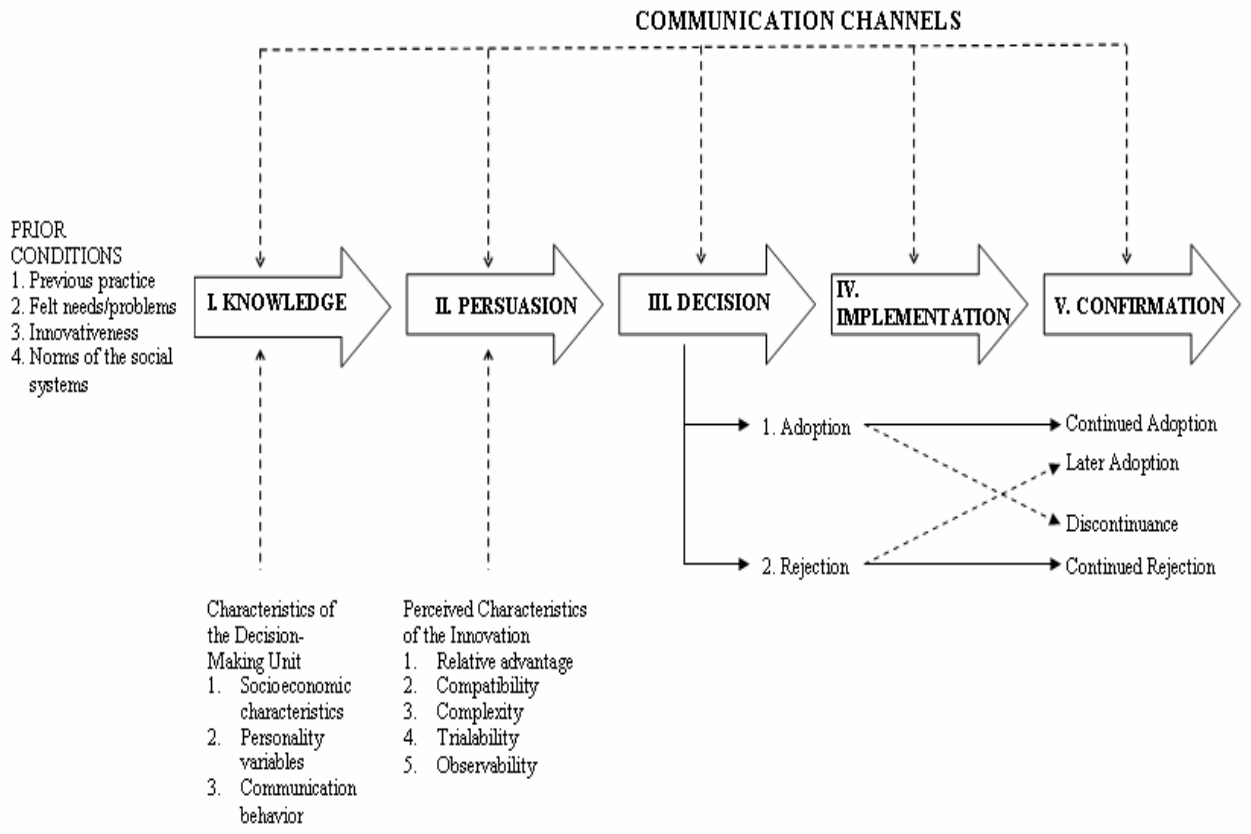
Diffusion of Innovations Theory

The Diffusion of Innovations Theory (DOI) provides a potential framework through which to understand HPV vaccine decision-making among African American adolescent females. In his well-known work, *Diffusion of Innovations*, sociologist Everett Rogers conceptualizes and describes the process by which individuals and social groups adopt

innovations [1]. Rogers describes the diffusion of an innovation as "the process through which an innovation is communicated through certain channels over time among the members of a social system" [1]. According to Rogers, an innovation is an idea, practice, or object that is perceived as new by an individual [1]. Among adolescents in the United States, the HPV vaccine is a new health innovation. Rogers' DOI framework is a multidisciplinary theory that is used to describe the diffusion of many types of innovations, including preventative health innovations and associated behavioral processes, like the HPV vaccine and HPV vaccine decision-making.

The DOI Innovation-Decision Process model is the process through which an individual passes when making a decision about the adoption of an innovation (Figure 1) [1]. The process begins with having knowledge or awareness of the innovation, to forming an opinion about the innovation, which then persuades the individual to make the decision to adopt or reject the innovation. Once the innovation has been adopted, the individual implements the innovation and confirms the decision to adopt. According to Rogers, the prior conditions and characteristics of the decision-making unit are strongly associated with an individual's knowledge of the innovation and their attitudes formed regarding the innovation. Knowledge and perceptions of the innovation persuade the individual to adopt or reject the innovation [1].

Figure 1. A Model of Five Stages in the Innovation-Decision Process [1]



According to Rogers' DOI Innovation Decision-Process, perceptions of the innovation are most influential in the adoption of the innovation and the rate at which the individual adopts the innovation [1]. The innovation characteristics that comprise this construct are: relative advantage, compatibility, complexity, trialability, and observability [1]. The prior conditions and characteristics of the individual, coupled with the dynamic between the individual's perceptions of the innovation, persuade or deter the individual to adopt the innovation. Further, innovations that are perceived to have greater relative advantage, compatibility, trialability, observability, and less complexity will be adopted in greater

numbers and quicker than those innovations that are not perceived to possess those characteristics [1].

In 2002, Rogers applied the DOI Innovation-Decision Process model to address preventative innovations [25]. According to Rogers, preventative innovations are new ideas or behaviors that require action at one point in time in order to prevent a negative consequence at a future point in time [25]. The HPV vaccine is a fitting example of a preventative innovation [26]. In the model for preventative innovations, Rogers explains that individuals are less likely to adopt preventative innovations due to the perceived characteristics of preventative innovation [25]. Specifically, the rewards or benefits for an individual to adopt a preventative innovation are delayed, intangible, and the negative consequence may not occur right away [26]. In effect, the perceived relative advantage to adopt rather than reject a preventative innovation is relatively low. Research conducted on perceptions of the relative advantage of an innovation shows that perceived relative advantage is the most important predictor of the rate of adoption of a preventative innovation, demonstrating why preventative innovations are slow to diffuse through a population [25]. Following Rogers' model, increasing the rate of adoption of a preventative innovation, like the HPV vaccine, requires that the perceived characteristics of the innovation, most importantly relative advantage, support the adoption.

Diffusion of Innovations Theory and Vaccine Uptake

Despite the fact that the HPV vaccine is a new preventative public health innovation, DOI has not been used to quantitatively conceptualize and explain the diffusion of the HPV vaccine or HPV vaccine decision-making. However, studies applying DOI to increase influenza vaccination uptake have shown to be effective, although limited [27] [28]. Additionally,

DOI constructs have been applied to qualitatively assess factors associated with HPV vaccine beliefs and HPV vaccine acquisition [29] [30]. The breadth and results of such studies are narrow but encourage further research examining the descriptive power of DOI as applied to HPV vaccine decision-making.

Previous theoretical frameworks and research studies have been unable to fully integrate all variables involved in HPV vaccination uptake, resulting in a limited understanding of the factors involved in adolescent female HPV vaccine decision-making, particularly among African American females. However, the DOI Innovation-Decision Process integrates all components of the decision-making process of an individual into one comprehensive framework, providing an improved understanding of factors involved in the diffusion of innovations, and more specifically preventative innovations.

Purpose of study

This study was developed in response to poor HPV vaccination rates among African American female adolescents living in the southern United States. Due to a limited understanding of the factors and dynamics associated with HPV vaccine decision-making among African American female adolescents, this study tests a new comprehensive theoretical framework to better explain the individual decision process to adopt the HPV vaccine innovation.

The purpose of this study is to examine correlates of HPV knowledge and intention to vaccinate against HPV among African American adolescent females within the context of the Everett Rogers' Theory of Diffusion of Innovations (DOI) [1]. Specifically, this study examines correlates of HPV and cervical cancer knowledge and intention to vaccinate against

HPV among African American adolescent females. In doing so, this study tests the explanatory power of the DOI Innovation-Decision Process model [1] as applied to HPV and cervical cancer knowledge and intent to vaccinate among African American adolescent females. Lastly, this research assesses the explanatory power of the DOI model for preventative innovations [25] as applied to HPV knowledge and cervical cancer and intent to vaccinate among African American adolescent females. The study hypothesis is that DOI can in fact provide an appropriate theoretical framework to understand and analyze HPV vaccine decision-making among African American adolescent females.

LITERATURE REVIEW

HPV Vaccination Coverage

Despite a safe and effective vaccine to protect against HPV, as well as opportunities for vaccine delivery in health-care settings, vaccination coverage among adolescent females in the United States is very poor. Upon FDA approval of the HPV vaccine in 2006, the ACIP has recommended that all females under 26 years of age receive the three dose vaccine series to prevent HPV infection, a virus that causes genital warts and several types of cancer, including cervical cancer [2]. Specifically, the ACIP recommends that adolescent girls receive the vaccination in early adolescence, around 11 or 12 years old [3]. However, national data from the National Immunization Survey (NIS) for Teens shows that as of 2012, 53.8% of adolescent females have initiated the vaccine series and only 35.2% have completed the vaccine series [3]. Further, trend data confirms that rates of vaccine series initiation and completion among adolescent females have now plateaued [3]. With two-thirds of the adolescent female population unprotected from HPV, under vaccination among adolescent females in the United States is a significant public health problem that must be addressed.

While, poor vaccination coverage among adolescent females should be targeted as whole, data exposes concerning racial and geographic disparities regarding HPV vaccine acquisition. The NIS for Teens data shows that in 2011, 56.0% of African American adolescent females initiated the vaccine and only 31.7% completed the series. Series completion among African American adolescent females is lower than both whites (33.0%) and Hispanics (41.6%) [19]. Additionally, data from the 2011 NIS for Teens shows that the southern United States has lower vaccine series initiation and completion than other regions

in the United States [19]. In the southern census region, only 30.6% of adolescent females 13-17 years have received all three doses of the HPV vaccine, in comparison to 39.9% in the Northeast, 33.5% in the Midwest, and 38.7% in the West [19]. In Georgia, the state in which this study takes place, 48.4% of adolescent females initiated the vaccine series and only 30.0% completed the series, five percent lower than the national average [19]. The racial and geographic disparities in HPV vaccination coverage are particularly disconcerting due to the fact that the prevalence of HPV infection, HPV related cancers, and HPV related cancer mortality is highest among African American females in the southern United States [13].

For the past fifteen years, public health researchers have produced a growing body of literature on HPV vaccination coverage. Such research has examined correlates of vaccine acceptability or intentions to receive the HPV vaccine as well as predictors of HPV vaccine series initiation and completion. Earlier research focused on HPV vaccine acceptability among providers, parents, and young adult females [31 32 33 34 35 36 37]. More recently, studies have examined correlates of vaccine initiation and series completion among adolescent females themselves. Overall, the literature in this field confirms that sociodemographic factors; knowledge; attitudes and beliefs; intention to get vaccinated; normative beliefs and social support; perceived susceptibility to HPV infection and severity of HPV; and perceived barriers associated with the HPV vaccine are the primary factors influencing HPV vaccine acceptance and HPV vaccine acquisition [38 14 39 40 41 42 43 18].

This chapter discusses the pertinent findings from the literature related to HPV vaccine decision-making among African American adolescent females. In doing so, this review assesses the sociodemographic, behavioral, attitudinal, and knowledge related factors associated with HPV vaccine acceptability and HPV vaccine uptake among adolescent

females. While many studies have focused on parents and health care providers in addition to the young females receiving the vaccination, this review focuses on the literature that examines the young women or adolescents themselves, due to the fact that this study's examined African American adolescent females aged 13-18 years. Further, this literature review discusses Everett Rogers' Theory of Diffusion of Innovations (DOI) and the application of DOI to adolescent female HPV vaccine decision-making [1].

HPV Vaccine Acceptability and Uptake

Sociodemographic factors

Existing literature on HPV vaccine acceptance and uptake demonstrates that HPV vaccine acceptance and uptake among adolescent females is predicted by various sociodemographic factors. Specifically, research shows that race and ethnicity, socioeconomic status, age, and healthcare coverage are correlates of vaccine uptake. For more than fifteen years, research studies and national level data have consistently shown that both race and socioeconomic status are correlates of both vaccine series initiation and completion [22 44 45 20 14 15 17 21 46 47 18]. In 2010, Kester et al. assessed a U.S. sample of mother daughter pairs to examine predictors of vaccine uptake [14]. Researchers found that African American adolescents were significantly less likely to complete the series than non-whites. In another study examining vaccine initiation among girls at high risk for HPV infection, African American adolescents were 40% less likely to get vaccinated [47].

In 2011, Niccolai et al. examined the effects of race and poverty on the initiation and completion of the HPV vaccine series using data from the National Immunization Survey (NIS) for Teens [15]. Consistent with most recent data from the 2012 NIS for Teens, African

American adolescent females were significantly less likely to complete the vaccination series than whites and Hispanics [15] [19]. Additionally, NIS for Teens data also consistently shows that adolescents living below the poverty line are less likely to complete the vaccination series than adolescents with higher household incomes [45] [19].

The findings from the literature regarding vaccination disparities by age are relatively mixed. Data from the NIS for Teens shows that older adolescents are more likely to vaccinate while younger adolescents are less likely to vaccinate [18] [3]. While many studies find high vaccination rates among older adolescents, others find that vaccination uptake does not differ greatly among older and younger adolescents [18]. Recent findings suggest that this low uptake among younger adolescents could be a result of providers not recommending the HPV vaccine to younger females [48] [18].

In addition to age, the literature demonstrates that healthcare coverage and healthcare access impact HPV vaccine initiation and series completion [14] [15] [49] [50] [49]. Findings consistently illustrate that adolescent females without health care coverage perceive more practical barriers to vaccination for reasons such as cost [42] [51]. As a result, adolescents with limited access to healthcare coverage are less likely to initiate and complete the vaccine series [49]. Higher vaccination rates are consistently seen among those with insurance compared to those without insurance. However, differences in series completion by insurance type have been inconsistent [52] [18]. Most studies show that those with private insurance are more likely to complete the vaccination series [18] [53].

Behavioral factors

Research has identified several behavioral factors that serve as predictors for HPV vaccine acceptability and HPV vaccine uptake among adolescent females in the United States. First, adolescents who have a history of vaccination are more likely to become vaccinated against HPV [14 18]. Also, studies show that individuals who engage in sexual behaviors that increase the risk for HPV infection were more likely to decline the vaccine and conversely, females who engage in less risky sexual behaviors are more likely to vaccinate against HPV [39]. However, another study found that increased sexual behavior in the past year actually increased vaccine uptake [47]. Also, research has illustrated that receipt of a gynecological exam or Pap smear within 3 years prior to initiating the vaccine is not a correlate of vaccine series completion [14]. Conversely, receipt of an abnormal Pap smear has been shown to predict vaccination [49].

Attitudinal factors

Research confirms that attitudes are the strongest predictors of HPV vaccine acceptability and uptake. Personal beliefs and attitudes regarding the HPV vaccine, HPV, and cervical cancer serve to influence the decision to get vaccinated [22 23 40 54 33 55 46 51 56 35]. Attitudes associated with HPV vaccine uptake include: perceptions of the HPV vaccine, benefits and barriers to vaccination, perceived susceptibility to HPV, perceived severity of HPV, and social support or social norms relating to HPV vaccination. Also, personal intention to vaccinate has been shown to be a significant predictor of vaccine uptake [14 33 51].

Studies consistently show that attitudes toward the HPV vaccine are fundamental in vaccine adoption [40 51]. Literature regarding HPV vaccine uptake has demonstrated the very

strong association between one's perceptions of the value of the HPV vaccine and vaccine uptake [54]. Negative attitudes of the vaccine are shown to hinder vaccine acceptance and uptake [56]. Adolescents that perceived the vaccine to have negative outcomes are less likely to become vaccinated [54]. Examples of negative outcomes that decrease vaccine uptake among adolescents are concern for safety and negative side effects [14 54]. Specifically, Gelman et al. exposed that there is general skepticism and a lack of acceptance of the HPV vaccine among African Americans women [22]. On the other hand, young women who report that they perceive the vaccine to be personally important or beneficial show higher vaccine uptake [23 54 55]. Notably, research has shown that perceived effectiveness of the vaccine is also a predictor of vaccine uptake [18 56 35.] In effect, researchers have underscored the importance of stressing the efficacy, safety, and benefits of HPV immunizations to improve perceptions of the vaccine, and as a result, vaccine uptake [23].

Research has also demonstrated the relationship between perceived barriers to HPV vaccination and HPV vaccine acquisition. Perceived barriers to vaccination, including the need for multiple doses and vaccine cost, are key predictors of low vaccination rates [15 55 56 35 49]. Also, perceiving barriers to HPV vaccination overall has predicted lower vaccine uptake in several studies [56 35]. The adolescents who report fewer perceived barriers to receiving the vaccination are more likely to get vaccinated [36].

Research shows that adolescent perceptions of social support and their normative beliefs are predictors of vaccine uptake [23 55 46 18 56 35 49]. Adolescents who report that the HPV vaccine aligns with their attitudes, beliefs, and social norms are more likely to become vaccinated [23 40 54 33 55 46 51 56 35 57 49]. Specifically, individuals who report that the HPV vaccine is supported or recommended by their family, peers, or healthcare provider are more

likely to accept, initiate, and complete vaccination [40 55 51 18 56 35 49]. Additionally, studies have shown that receipt of a provider recommendations serves to increase positive perceptions of the vaccine and is significantly correlated with vaccine uptake and series completion among adolescents [18 56 35 57 49]. This could be in part due to the fact that providers stress the benefits of vaccination. Provider recommendation is a consistently strong predictor of HPV vaccine uptake among adolescent females [18]. In one study, parents that reported that a healthcare provider recommended the vaccine had nearly 50 times the odds of reporting that their daughter was vaccinated than those that did not receive a recommendation. However, only one third of parents reported receiving a provider recommendation [18 56].

Perceived susceptibility to HPV infection and perceived severity of HPV infection are also associated with vaccine uptake [23 39 33 58 59]. Notably, individuals who report a high-perceived susceptibility or severity of HPV infection are more likely to initiate vaccination being that the vaccine protection outweighs the perceived costs, risks, or barriers [56 35 60 59]. Individuals who worry about the negative effects of not vaccinating are more likely to get vaccinated than those who do not perceive themselves to be susceptible to HPV or perceive HPV to be a serious health threat [18 56 35].

Knowledge factors

The existing literature shows that knowledge and awareness of HPV, the HPV vaccine, and HPV related health outcomes like cervical cancer are predictors of HPV vaccine acceptability and uptake. Findings indicate that the overall level of knowledge concerning the HPV infection and the HPV vaccine is very low in the United States [40]. A systematic review of predictors of HPV vaccine acceptance among adolescents found that several studies

identified greater knowledge about HPV vaccination as a correlate of HPV vaccine acceptance [35].

Lack of knowledge regarding HPV, cervical cancer, and the HPV vaccine is a fundamental predictor of not initiating or completing the HPV vaccine series in both hypothetical vaccine uptake situations and actual vaccine uptake studies [6 14 17 21 40 55 51 36 42 18 56 35]. Also, limited knowledge and awareness is frequently noted as an obstacle to vaccine uptake [14 22 40 54 55 42 18 56]. Notably, one study demonstrated that increased knowledge of the vaccine increased intentions to get the vaccine [42].

Specifically, the lack of knowledge in minority populations has been associated with the lack of acceptance and uptake of the HPV vaccine [22 44 15]. The NIS indicated that African American women were significantly less likely to have heard of HPV or the HPV vaccine and recommend it to their daughters [22 44]. Due to these findings demonstrating the importance of knowledge on vaccine acceptance, researchers in the field have frequently recommended that education about the HPV vaccine be a priority among adolescent females being that knowledge is a fundamental correlate of HPV vaccine acceptance and uptake [36].

Limitations of the Literature

The existing body of research on HPV vaccine coverage, acceptability, and uptake possesses several limitations that expose the need for an improved theoretical framework to better understand this public health issue. While there is an expanding field of research examining correlates of vaccine acceptability and uptake, a substantial weakness is that, overall, the findings are rather disparate and a-theoretical [40]. As a result, a comprehensive understanding of the factors that influence vaccine decision-making among adolescents is

limited. Many studies that have been conducted were not grounded in theory, while other studies commonly used the Theory of Planned Behavior, the Health Belief Model, the Information Motivation Behavior Model, and the Transtheoretical Model to explain HPV vaccination acceptability and uptake. Regardless, such theory grounded studies were critiqued for being far too theoretically narrow [40 33 55]. Without adequate theoretical underpinnings, studies cannot take into account the broad range of constructs and characteristics that comprise the complex vaccine adoption process among adolescents [40]. This is exceptionally important being that the literature on this topic demonstrates that HPV vaccine adoption or rejection is the result of the interplay between numerous sociodemographic, behavioral, attitudinal and knowledge variables.

Another limitation of the literature is that much of the early research examined correlates of acceptability or intention to vaccinate in hypothetical situations. Only recently has research focused on predictors of HPV vaccine series initiation and completion [61]. Examining correlates of vaccine acceptability or intention to vaccinate in hypothetical situations is problematic being that the relationship between self-reported intentions to vaccinate against HPV and actual behavior only moderately correlate [40 35 41].

Additionally, few studies examine adolescent females, the population that receives the HPV vaccine. Instead, much of the research on HPV vaccine acceptability and uptake has focused on health care providers, parents, or young adult women [55 58 49 50 56 21 37]. Further, fewer studies have examined acceptability and uptake among racial or ethnic minority groups, like African American adolescents, despite the racial disparities in HPV prevalence and HPV vaccine uptake among this population [13 15 41 35 40 21]. In a recently published article, Gelman et al examined factors contributing to racial and ethnic disparities in HPV

vaccination uptake among adolescent females [44]. The authors concluded that while socioceconomic and health care access variables explained under vaccination among Hispanic adolescent females, more research is needed to understand factors contributing to poor vaccination rates among African American adolescents [44]. Such findings underscore the need for more research on HPV vaccine decision-making among African American adolescents.

An additional methodological limitation of the existing literature in this field is that most studies are cross-sectional [35 41 40]. There are few longitudinal studies examining vaccination uptake among adolescent females, limiting knowledge of factors that predict vaccination. Also, as a result of a limited understand of factors associated with vaccination, there are few intervention studies examining the efficacy of HPV vaccine promotion strategies. In effect, there are only a small number of moderately successful intervention strategies [54 33 46]. Due to poor vaccination rates among African American adolescent females, there is an inherent need for an improved understanding of the correlates of under vaccination as well as effective intervention approaches.

As a result of the narrow theoretical and methodological foundations of the existing research on HPV vaccine decision-making, there is an incomplete understanding of the dynamic between the prior conditions and characteristics of an individual, knowledge, and the individual's perceptions of the HPV vaccine innovation- all shown to be correlates HPV vaccine acceptability and uptake. An understanding of the interplay between these factors and HPV vaccine uptake is largely limited and unascertainable within the narrow research models that have been previously used. As the limitations of the literature show, future research must be grounded in a comprehensive theoretical framework.

Diffusion of Innovations Theory

Research on HPV vaccine acceptability and uptake has served to inform public health's understanding of the multitude of factors associated with adolescent HPV vaccine decision-making. Despite fifteen years of research on this topic, vaccination coverage remains low, particularly among African American adolescent females in the southern United States [19]. Poor vaccination coverage and halted increases in vaccination rates are likely a result of public health's inadequate understanding of under vaccination among this population [44]. The limitations of the literature on HPV vaccine decision-making demonstrate a significant need for further research examining correlates of HPV vaccine uptake among African American females. Most importantly, improved theoretical frameworks are needed in order to fully conceptualize HPV vaccine decision-making being that previously used theoretical frameworks have been unsuccessful at integrating the various factors and dynamics involved in HPV vaccine uptake.

Although the Everett Rogers' Diffusion of Innovations Theory (DOI) has never been used to quantitatively conceptualize and explain HPV vaccine decision-making, the existing literature on HPV vaccine acceptability and uptake among adolescent females supports the application of this model to HPV vaccination [1]. The DOI Innovation-Decision Process model affirms that knowledge, prior conditions and characteristics of the decision-making unit, and perceptions of the innovation are factors involved in an individual's decision to adopt or reject an innovation [1]. According to DOI, knowledge of the innovation is strongly associated with individual perceptions of the innovation and the decision to adopt the innovation. The findings from the literature regarding the relationship between HPV vaccine acceptance and vaccination are concurrent with the DOI model. Research shows that increased knowledge

and awareness of the HPV vaccination is associated with vaccine acceptability and uptake among adolescent females [40 35 40 18 36 21]

The DOI Innovation-Decision Process model also asserts that the prior conditions of the individual influence the individual's knowledge, perceptions of the innovation, and eventually their decision to adopt or reject the innovation [1]. Literature demonstrates that previous practices or existing conditions of individuals are in fact correlates of knowledge, perceptions of the innovation, and vaccine uptake [21 35 56 40 61 14,18 36]. Additionally, research shows that the characteristics of the decision-making unit also serve as correlates of HPV vaccine acceptance and uptake. (For example, various studies have shown that both race, level of education, and socioeconomic status are predictors of vaccine series initiation and completion [44 24 18 14 45 22 61]. Such findings illustrating the association between characteristics of the individual and vaccination are concurrent with Rogers' Innovation-Decision Process model [1].

Furthermore, the DOI Innovation-Decision Process model posits that the perceptions of characteristics of the innovation persuade the individual to accept or reject the innovation [1]. Research on HPV vaccination supports this association between vaccine perceptions and acceptability or uptake [31 55 14 56 35 42 39]. The literature demonstrates that there is a very strong association between an adolescent's perceptions of the HPV vaccine and HPV vaccine acceptance or uptake [31 49 55 14 35 35 36 54]. Further, those that perceived the vaccine to have negative outcomes are less likely to become vaccinated [54]. Notably, individuals who report a high-perceived susceptibility or severity of HPV infection are more likely to initiate vaccination due to their perceptions that HPV vaccine protection outweighs the barriers to vaccination [35 56 58 59 23]. In applying the findings from the literature on correlates of HPV

vaccine acceptability and acquisition to the DOI model, it is apparent that DOI is an appropriate and comprehensive theoretical model to HPV vaccine decision-making among adolescent females.

Diffusion of Innovations Theory and Vaccination Uptake

Very little research has been conducted applying DOI to preventative innovations like vaccines. However, DOI has been utilized successfully to increase influenza vaccine uptake among adolescents [27] [28]. In these two experimental studies, the use of DOI resulted in higher immunization rates among adolescents in a school based setting. However, the studies did not examine the explanatory power of the Innovation Decision-Process model. Instead, the studies used DOI to ground the intervention approach [27] [28]. Nonetheless, the effective application of DOI to influenza vaccination promotion is encouraging for the use of this theory to explain HPV vaccination adolescent females.

Recently, two qualitative research studies were published that used DOI to examine factors that influence HPV vaccination among females [29] [30]. Both qualitative studies found that the DOI constructs can serve to successfully conceptualize and understand vaccine acquisition among females. Using focus groups in Australia, D'Souza et al examined the relationship between perceived characteristics of the innovation and the rate of adoption of the vaccine [29]. With this, the researchers were able to improve understanding of vaccination diffusion using Rogers' theory of preventative innovations [25].

Cohen et al used DOI to identify knowledge-attitude-practice gaps in the context of the HPV vaccine to explain why the diffusion of a preventative innovation, like the HPV vaccine, requires targeted strategies in order to increase uptake [30]. In conducting in-depth

interviews with young adult women in the United States, the findings from the study support the application of DOI to understand HPV vaccine decision-making. The researchers found that HPV risk protection behavior is more of an important factor than knowledge in vaccine acquisition [30]. Further, unvaccinated women often reported negative perceptions of the HPV vaccine and higher risks associated with vaccination [30]. Researchers also reported that, just as DOI posits, the normative beliefs and interpersonal networks of an individual serve to influence both adoption and rejection of the vaccine [30].

While the literature examining the diffusion of vaccinations supports the application of DOI to understand factors associated with the adoption of the HPV vaccine innovation, no research has been conducted to test the efficacy of the DOI Innovation-Decision Process model to conceptualize and analyze HPV vaccination. Further, DOI has not been applied to understand adolescent female, or African American adolescent female, HPV vaccine decision-making. Due to the need for an improved theoretical framework to understand and address this pressing public health issue, research must be conducted to quantitatively test the explanatory power of DOI as applied to HPV vaccine decision- making, particularly among African American adolescent females.

Research Questions

The purpose of this research study is to examine correlates of HPV knowledge and intention to vaccinate against HPV among African American adolescent females within the context of the Everett Rogers' Diffusion of Innovations Theory (DOI) (Figure 1) [1]. This research aims to answer the following research questions:

1) What are correlates of HPV knowledge and intention to vaccinate against HPV among African American adolescent females?
2) Can components of the DOI Innovation-Decision Process model [1] explain HPV knowledge and intent to vaccinate against HPV among African American adolescent females?
3) Can components of the DOI model for preventative innovations [25] explain HPV knowledge and intent to vaccinate against HPV among African American adolescent females.

METHODS

The research questions were answered through a secondary analysis of quantitative data from the *Girls OnGuard: HPV Vaccination Uptake among African American Adolescent Females* study conducted at the Rollins School of Public Health. The Principal Investigator of the study is Ralph DiClemente, Ph.D. and the Co-Investigators of the study are Gina Wingood, Sc.D, Colleen Crittenden Murray, Ph.D. and Jessica McDermott Sales, Ph.D.

Primary Study Design

Girls OnGuard used a randomized control trial to evaluate the efficacy of a clinic-based HPV vaccine media intervention for African American adolescents in Atlanta, Georgia. The study applied the Information-Motivation-Behavioral Skills Model (IMB) as a framework to guide the development of the *Girls OnGuard* media intervention. The intervention tested was an interactive computer-delivered program promoting HPV vaccination, relative to a health promotion comparison condition. Prior to randomization to study conditions, adolescents completed an audio-computerized assisted self-interview (ACASI) designed to assess sociodemographic factors, sexual behaviors, and knowledge, attitudes and beliefs about HPV and vaccination with Gardasil. Medical record abstraction was conducted 7 months post-randomization to assess uptake of Gardasil.

Sample

To be eligible for participation in *Girls OnGuard*, adolescents had to identify as: (1) an African American female; (2) 13-18 years of age at the time of enrollment into the project; (3) unmarried; (4) seeking reproductive/STI health services; (5) not having received the HPV vaccine previously; and (6) provide written informed consent and HIPAA when applicable.

Adolescents who refused to provide written informed consent were excluded. No parental consent was required in accordance with the state of Georgia health policy as participants were seeking confidential services in a reproductive health clinic. All participants seeking STI services received standard-of-care counseling. A total of 216 African American adolescent females participated in the *Girls OnGuard* Intervention. Of the 216 participants, 108 were randomized to the intervention group and 108 were randomized to the control group. The data from all 216 participants was included in this secondary study.

Setting

Participants were recruited in the waiting rooms of several reproductive health clinics within the surrounding Atlanta Metropolitan area. Individuals were recruited from Carroll County Board of Health, Clayton County Department of Health, DeKalb County Board of Health (Clifton Springs Health Center), Fulton County Department of Health and Wellness (Aldredge Health Center) and Planned Parenthood Southeast (Atlanta Clinic) from 2009 to 2012.

DeKalb County Board of Health

The DeKalb County Board of Health continually strives to meet the varied health needs of all the residents of DeKalb County. Although the county is mostly suburban it also includes an urban area (part of the city of Atlanta) as well as rural areas. Also, DeKalb's more than 660,000 residents represent more ethnic groups than any other county in the southeastern United States. Within DeKalb County there are 6 health centers, all of which provide services to young women. In particular the Board of Health works with the citizens of DeKalb County in the following ways: 1) Partnering with neighborhoods, PTAs, civic

groups, faith organizations and others to improve health, 2) Tracking health trends so that resources can be focused on the most pressing concerns, 3) Raising public awareness of local health issues, 4) Stopping the spread of disease through education and early detection, and 5) Providing services to help people stay well.

Fulton County Department of Health and Wellness

The Fulton County Department of Health and Wellness (FCDHW) serves the largest county in the state of Georgia, covering a 535 contiguous square mile area and encompassing approximately 88% of the city of Atlanta. The main facility is located in the older section of downtown Atlanta in the heart of an area with high rates of violent crime, substance abuse, and poverty. Included in this population are richly diverse communities of color, ethnicity and class distinction, and a significantly large uninsured population. African Americans are a majority of the population in this geographic area.

FCDHW provided health services to over 128,360 individuals and documented 5,033 teen visits to their STI Clinic. Over 90% of teens were contacts to partners with an STD or exhibited signs of exposure to STIs. The median age attending the STI Clinic was 16 years. A review of FCDHW data indicates that among adolescents 13-18 years of age who attended the STI Clinic for diagnosis/care, girls outnumbered boys by about two to one; illustrating the disproportionate STI burden experienced by girls. Also among this age group, for 14 every one White girl seeking diagnosis/care for STIs, 104 African American girls sought STI diagnosis/care. Aside from chlamydia, gonorrhea and trichomoniasis, there were markedly fewer cases of other STIs, such as syphilis

Planned Parenthood Southeast

Planned Parenthood Southeast serves Fulton County, the largest county in the state of Georgia, covering a 535 contiguous square mile area and encompassing approximately 88% of the city of Atlanta. The main facility is located in the older section of downtown Atlanta, the proposed study site, in the heart of an area with high rates of violent crime, substance abuse, and poverty. Included in this population are richly diverse communities of color, ethnicity and class distinction, and a significantly large uninsured population. African Americans comprise a majority of the population in the immediate geographic area. Planned Parenthood of Georgia, after the county health department, is the major provider of sexual health services to low income women in Fulton County. In 2002, Planned Parenthood of Georgia's downtown Atlanta location provided health services to 1,300 teens. The majority, 95% of adolescents, were sexually active and sought services for birth control, pregnancy testing or STI testing.

In this age group of adolescents, relative to White females, African Americans were three-times more likely to be diagnosed with an STI. This racial/ethnic disparity in STIs illustrates the disproportionate STI-burden experienced by African American female adolescents and is a key factor motivating our research team to develop and evaluate the *Girls OnGuard* intervention for African American female adolescents. Of particular importance for this study is the mission of Planned Parenthood of Georgia to include a greater emphasis on prevention and health promotion activities.

Clayton County Board of Health

The Clayton County Board of Health offers a wide array of clinical and community health prevention services focused on preventing disease, injury, disability and premature death. Clayton County, with a population of more than 270,000, is one of the five core counties that make up metropolitan Atlanta and is served by two health facilities. The Board of Health Partnerships include the Clayton County Collaborative Authority, Southern Regional Health Systems and numerous social service, educational faith-based, and multi-ethnic community partners.

In particular, The Clayton County Adolescent Health and Youth Development Center was designed to enhance the skills and improve the health status of adolescents through opportunities and programs developed in collaboration with families, communities, schools and other public and private organizations throughout Clayton County. Programs and services target youth ages 10 to 19**.** Clayton County Adolescent Health and Youth Development Center sponsors programs that reinforce positive attitudes, healthy behaviors and activities to decrease such behaviors as violence, substance abuse, poor school performance and early sexual activity. The center provides a comprehensive and holistic approach with assisting youth with clinical services, teen support, educational workshops, leadership and development programs, and parenting resources. The Adolescent Health and Youth Development Center provides a "teen-friendly" clinic and safe atmosphere for the youth of Clayton County.

Carroll County Board of Health

Carroll County is located in the west central section of Georgia on the Georgia-Alabama state line and is approximately 49 miles west of downtown Atlanta. The Carroll County Board of Health offers an array of services, such as family planning, sexually transmitted infections and women's health services to a population of 106,965 (US Census Bureau, 2006). The mission of the county's health department is to promote wellness and protect the health and well-being of all people who live and work in Carroll County. The Board of Health unites with individuals, families, organizations and communities to promote and enhance disease and injury prevention services that will ultimately improve and secure a healthy lifestyle.

Recruitment

Recruitment was conducted between March 2010 and December 2012. Trained research staff recruited participants in partner clinic site waiting rooms. Upon being approached by recruitment staff, all prospective participants were screened for eligibility by trained *Girls OnGuard* staff. To be eligible to participate in *Girls OnGuard*, participants had to identify as (1) female, (2) African American, (3) between 13-18 years of age, (4) unmarried, (5) not pregnant, (6) not having received the HPV vaccine, and (7) seeking STI and reproductive health services at a participating clinic.

All eligible participants provided written informed consent and HIPPA, when applicable (Appendix A) (Appendix B). No parental consent was required being that participants were seeking confidential services in a reproductive health clinic and HPV vaccinations at participating clinics could be obtained without parental consent. All

participants received the standard of care counseling and services by clinic providers. Participants received ten dollars for participating in the study. Following the completion of the study, if participants requested HPV vaccination, the cost of the vaccine was defrayed under the Vaccines for Children (VFC) Program and administrative fees, if incurred, were waived and covered by the study. All monetary barriers to vaccination were removed. The confidentiality of participants' data and identity was ensured. This study was approved by the Emory University Institutional Review Board and the Institutional Review Board of all participating clinic sites on December 10, 2008 (Appendix C).

Procedures

Following recruitment, eligibility screening, and consent, participants completed an ACASI survey at baseline. Research staff provided participants with a small laptop computer, described the brief 15-minute ACASI, and permitted participants to ask questions. The ACASI survey assessed participant variables such as sociodemographic factors, sexual history and behaviors, and knowledge, attitudes and beliefs about HPV and the Gardasil vaccination.

Upon completion of the baseline ACASI assessment, participants were randomized into one of two groups by the research staff. Participants randomized to the intervention group viewed a twelve-minute interactive computer delivered message on the Gardasil HPV vaccine designed to enhance initial uptake of Gardasil. Those randomized into the health comparison group received a gender, culturally appropriate and time equivalent health promotion message on general health and nutrition. Study procedures were initiated and completed while participants were in the clinic waiting room.

At 7 months post-randomization, research staff initiated medical record abstraction. Medical records were reviewed to assess whether participants received an initial dose of Gardasil, how many total doses of the Gardasil vaccine were received, and the date that each dose of the vaccine was received. In addition, clinic charts were reviewed for any positive STI diagnoses during this time, including the baseline clinic visit. HIV diagnoses were excluded and not recorded.

Secondary Study Design

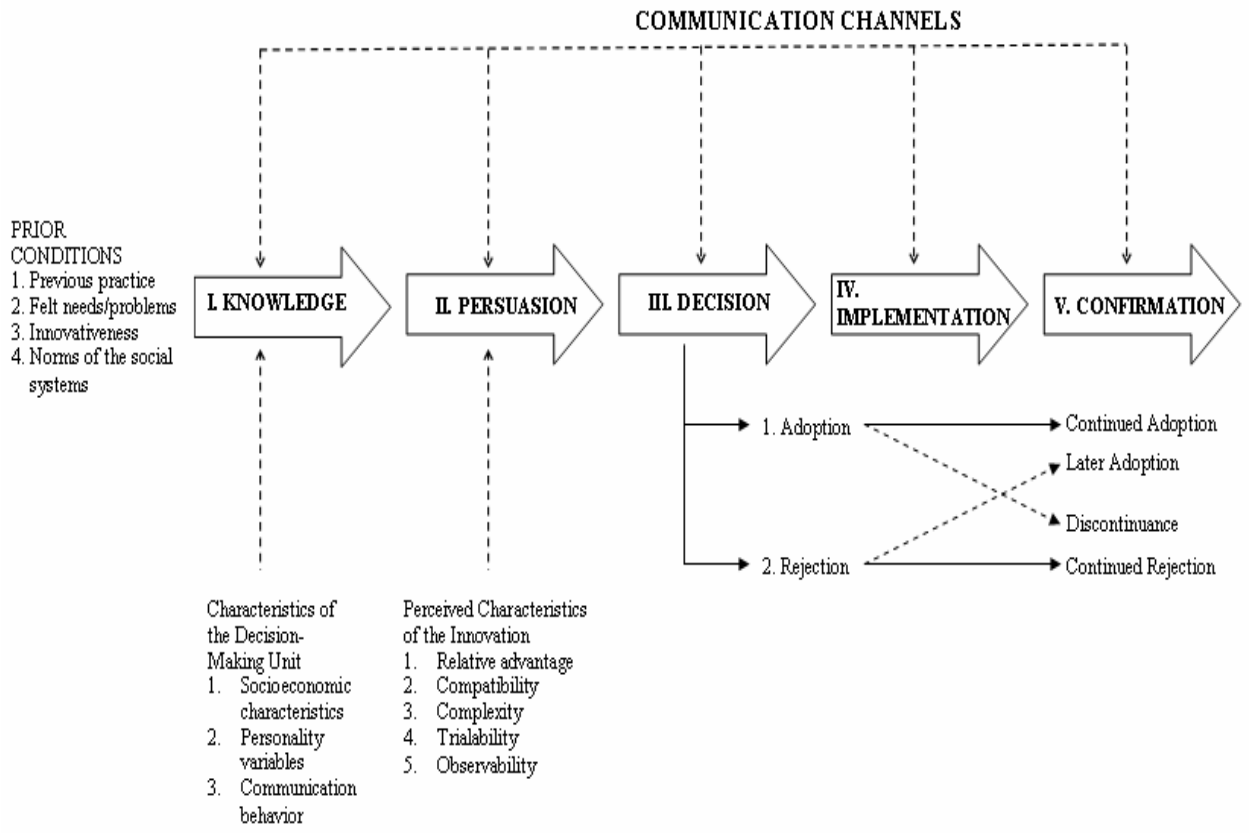
The purpose of this secondary data analysis was to examine correlates of HPV knowledge and intention to vaccinate against HPV among African American adolescent females within the context of the Everett Rogers' Diffusion of Innovations Theory (DOI) (Figure 1) [1]. This research aimed to answer the following research questions:

1) What are correlates of HPV knowledge and intention to vaccinate against HPV among African American adolescent females?
2) Can components of the DOI Innovation-Decision Process model [1] explain HPV knowledge and intent to vaccinate against HPV among African American adolescent females?
3) Can components of the DOI model for preventative innovations [25] explain HPV knowledge and intent to vaccinate against HPV among African American adolescent females?

To answer the research questions, two study design phases were implemented. First, applicable variables and constructs measured in the *Girls OnGuard* ACASI survey were identified then mapped to the DOI Innovation-Decision Process model constructs (Appendix:

D). Second, a cross-sectional analysis was conducted using the baseline ACASI data collected from the *Girls OnGuard* study participants (n=216).

Figure 1. Innovation-Decision Process model [1]



Measures

Primary Study Measures

The quantitative data that will be examined in this study was collected using the *Girls OnGuard* ACASI baseline survey and medical chart abstraction 7-months post randomization (Appendix: D). The ACASI quantitative survey items measured various constructs with variables and scales that might be associated with the uptake of the Gardasil HPV vaccination. The ACASI survey items measured: sociodemographic variables; sexual,

medical and relationship history; HPV and cervical cancer, knowledge; perceived susceptibility and severity of HPV and cervical cancer; perceptions about vaccines in general and the HPV vaccine; HPV vaccine acceptability; and normative beliefs. Selection of measures for inclusion on the ACASI was guided by a number of factors, including: 1) relevance of the construct for influencing Gardasil vaccination; 2) use of the measure with similar populations; and 3) the underlying theoretical framework, IMB.

Sociodemographics

The ACASI measured the adolescents' age, level of education, living situation, whether anyone in the household received government assistance, if the participant had a job, and their current health insurance coverage. The ACASI also assessed whether any family member had been diagnosed with cancer (in general) or cervical cancer (specifically), and whether they had personally been tested (through a Pap smear) or told by a clinician they have HPV infection.

Sexual history

The ACASI measured the adolescents' sexual history using items developed by the *Girls OnGuard* research team. These items assessed: sexual debut, age of sex partners, number of sex partners in last 3 months and lifetime, frequency of sex and condom use in the last 3 months, pregnancy and STI history, alcohol/drug use prior to sex, and relationship history including casual sex partners. Many of these items were developed by the researchers' STI/HIV Research Group and have been used extensively with African American girls of the same age attending clinical venues.

Knowledge of HPV and cervical cancer

Knowledge about HPV was assessed using an 11-item scale, with true-false responses, developed by Kahn et al. [31]. Items were recoded with correct responses receiving a score of "1" and all others "0". Items were summed to get a composite score reflecting the total number of correct responses.

Perceived susceptibility and severity of HPV and cervical cancer

Participants completed a set of questions assessing perceptions of risk and seriousness of HPV and cervical cancer. The subscale on perceptions of risk was comprised of 10 items and perceived seriousness of cervical cancer was comprised of 12 items that were adapted from previous studies by Ingledue et al. [32] and Marlow et al [62]. Participants rated responses on a four-point Likert scale from "strongly agree" to "strongly disagree". Examples of items include: "HPV is a life-threatening disease" and "My chances of contracting HPV are low". The Ingledue et al. [32] statements were developed for an older age group, however, over a two-week period, high test-retest reliability coefficients were reported: .90 for knowledge and .95 for perceptions. A composite summed score was created by adding individual items. Individual questions were coded/recoded so that higher numbers indicated a greater perceived susceptibility/severity of HPV and cervical cancer.

Perceptions about vaccines in general and the HPV vaccine.

Perceptions about vaccines in general were assessed by 7 items. Three items were from Gerend et al. [33] and four items were modified from Marlow et al. [62]. Examples of statements include: "Vaccines are the most effective way to prevent disease" and "I am concerned about possible bad side effects of any vaccine". Perceptions about the HPV

vaccine in particular was measured using 4 items adapted from Marlow et al [62] [63]. Example statements include: "I would be very worried about the side effects of the HPV vaccine" and "Getting the HPV vaccine would be a good way to protect myself against cervical cancer". Participants rated responses on a four-point Likert scale from "strongly agree" to "strongly disagree". Responses were coded/recoded and then summed separately for general vaccine questions and HPV vaccine specific questions so that higher numbers indicated more negative perceptions.

HPV vaccine acceptability

Participants completed a set of items from two related scales, one developed by Gerend et al. [33] and the other by Zimet et al. [37]. Participants completed a modified five-item measure assessing HPV vaccine acceptability/likelihood of vaccination. Examples of items include: "How likely is it that you will try to get more information about the HPV vaccine?" "How likely is it that you will get the HPV vaccine?" Responses were rated on a 6-point Likert scale from "very unlikely" to "very likely." Cronbach's alpha was high (0.90).

Normative beliefs

Participants were assessed using 4 items on who they believe would be supportive of them receiving the HPV vaccine. Participants responded to statements as either "agree" or "disagree". Example statements include: "My doctor will think it is a good idea for me to get vaccinated." "My parent/guardian thinks I should get the HPV vaccine." These items were developed by the *Girls OnGuard* research team and were modified from previously used items with similar populations.

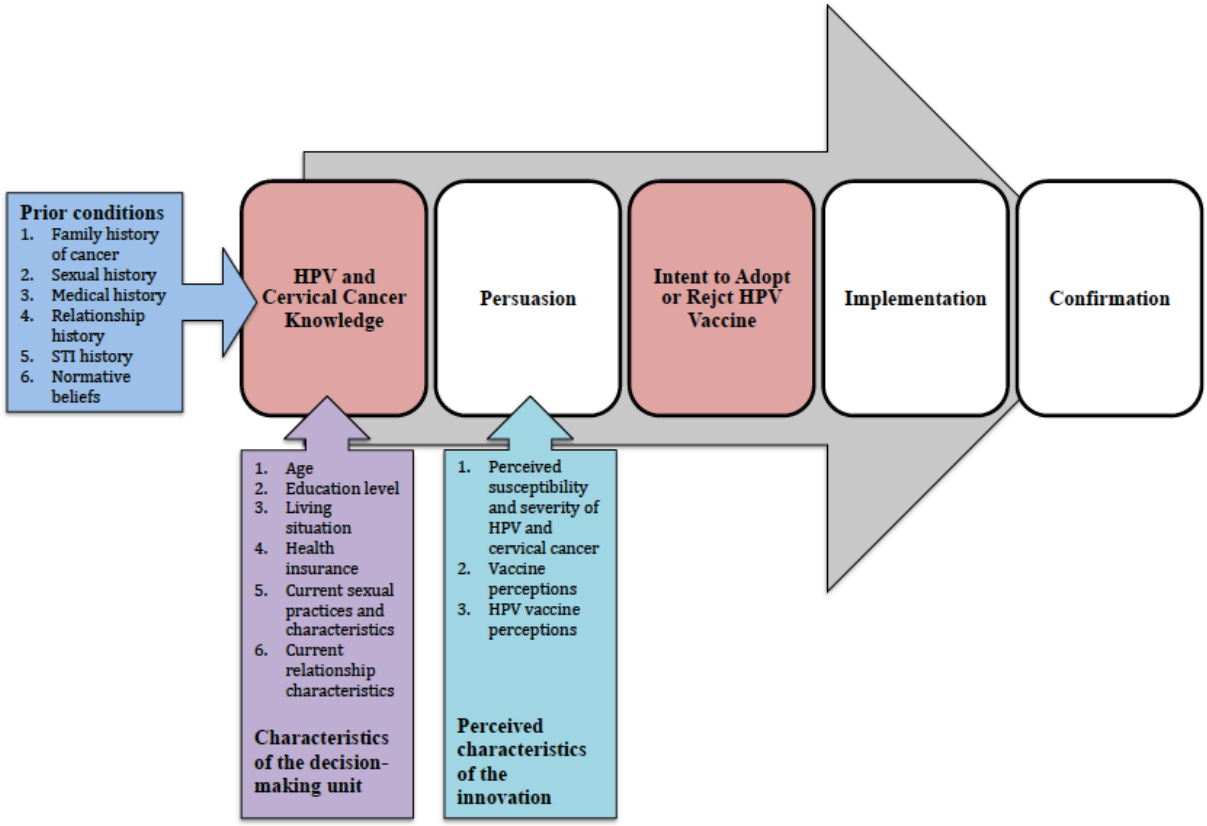
Medical record abstraction to assess HPV vaccination and STI incidence

The primary study outcome was Gardasil vaccination. To capture relevant data, clinic records were reviewed to identify whether and when (day/month) adolescents received a Gardasil vaccination. This permitted capturing data on the number of Gardasil doses received and their temporal sequencing (date/month). A secondary outcome was STI incidence within 7 months post randomization of each participant, beginning at baseline. A Medical Record Abstraction Form (MRAF) was created with the assistance of clinic staff to document this information.

Secondary Study Measures

For the purpose of this study, the pertinent variables and scales measured in the *Girls OnGuard* ACASI survey were identified and mapped to correspond with the DOI Innovation-Decision Process constructs: 1) prior conditions, 2) knowledge, 3) characteristics of the decision making unit, 4) perceived characteristics of the innovation and 5) intent to vaccinate, thus operationalizing the DOI constructs and characteristics (Figure 2) (Appendix D). While the intent to adopt the innovation is not a construct of the DOI model, it was used in this study to replace vaccine uptake or adoption. Vaccine uptake was not included as a variable in this study due to the fact that the statistical power present in the data was not sufficient for the requisite analyses. However, studies consistently demonstrate that intent to vaccinate for HPV is a strong predictor of HPV vaccination among adolescent females [33 54 64 14]. Therefore, intent to vaccinate was the most appropriate variable to replace vaccine uptake in order to test the application of DOI to HPV vaccination decision-making.

Figure 2. *Girls OnGuard* ACASI measures applied to the DOI Innovation-Decision Process model



Prior conditions

Rogers explains the prior conditions of the decision-maker as their previous practices or conditions, felt needs, and normative beliefs or perceived norms of the social system [1]. Items from the ACASI were identified and mapped to describe the prior conditions construct. The items included measured: family history of cancer, gynecological and medical history, sexual history including pregnancy, anal sex and oral sex variables, STI history, and the normative beliefs scale. The normative beliefs scale was the same scale described in the primary measures.

HPV and cervical cancer knowledge

The primary study knowledge score was used to measure HPV and cervical cancer knowledge. Knowledge about HPV was assessed using an 11-item scale, with true-false responses, developed by Kahn et al. [31]. Items were recoded with correct responses receiving a score of "1" and all others "0". Items were summed to get a composite score reflecting the total number of correct responses.

Characteristics of the decision-making unit

Rogers describes the characteristics of the decision-making unit as the socioeconomic characteristics, demographic variables, personality variables, and communication behavior of the individual decision-maker [1]. Items from the ACASI were identified and mapped to describe the characteristics of the decision-making unit. The items included measured: age, level of education, living situation, whether anyone in the household received government assistance, if the participant had a job, current health insurance coverage, current sexual practices and characteristics, and current relationship characteristics.

Perceived characteristics of the innovation

Rogers posits that the perceived characteristics of the innovation is defined by the decision-maker's perceptions of the innovation with respect to its relative advantage, compatibility, complexity, trialability and observability [1]. Three scales from the primary study measures were used to measure and describe perceived characteristics of the innovation in this study. The primary study scales used were: 1) perceived susceptibility and severity to HPV and cervical cancer infection, 2) general vaccine perceptions, and 3) HPV vaccine perceptions.

Intent to vaccinate against HPV

Both intent to vaccinate today and intent to vaccinate in the next 12 months with a provider recommendation were measured. The items asked, "How likely is it that you will actually get the HPV vaccine today?" and "How likely is it that you will get the HPV vaccine if a healthcare provider offers it to you in the next 12 months?" Responses were rated on a 6-point Likert scale from "very unlikely" to "very likely." Both items measuring intent to vaccinate against HPV were recoded into dichotomous variables measuring whether participants were "likely" or "not likely" to vaccinate today and in the next 12 months with a provider recommendation.

Analyses

SPSS software was used to perform the analyses of data for this research study. Descriptive statistics of all variables measured in the secondary analysis were analyzed for all study participants (n=216). Cronbach's alpha scores were calculated to demonstrate the internal consistency and reliability of the scales used. Bivariate analyses were conducted to test variables for inclusion in the regression model analyses. The bivariate analyses conducted were: Pearson correlation, independent t-test, chi-square, and one-way ANOVA. Variables associated with the dependent variable on a bivariate level at $p<.20$ were included into the regression model analyses. Variables in the regression models were tested for statistical significance at $p<.05$.

Three groups of bivariate regression analyses were conducted to test for the correlates of the following three dependent variables: 1) HPV and cervical cancer knowledge, 2)

intention to vaccinate today, and 3) intention to vaccinate in the next 12 months with a provider recommendation.

1) DOI correlates of HPV and cervical cancer knowledge

a) A linear regression analysis was conducted to examine the correlation between prior conditions of the decision-making unit and HPV and cervical cancer knowledge. HPV and cervical cancer knowledge served as the dependent variable and the variables measuring prior conditions of the decision-making unit were the independent variables. Variables that describe prior conditions of the decision-making unit were included as covariates. The covariates included were variables measuring: sexual history, relationship history, family history of cervical cancer, medical history, anal sex, oral sex, STI history, and normative beliefs.

b) A linear regression analysis was conducted to examine the correlation between characteristics of the decision-making unit and HPV and cervical cancer knowledge. HPV and cervical cancer knowledge served as the dependent variable and variables measuring characteristics of the decision-making unit served as the independent variables. Variables that describe characteristics of the decision-making unit were included as covariates. The covariates included were variables measuring: demographics, socioeconomic status, current relationship status, current sexual practices, and STI at baseline.

d) A linear regression analysis was conducted to test the relationship between perceived characteristics innovation and HPV and cervical cancer knowledge. HPV and cervical cancer knowledge served as the dependent variable and variables that described perceived characteristics of the innovation served as covariates. The covariates included

were: general vaccine perceptions, HPV vaccine perceptions, and perceived susceptibility and severity to HPV and cervical cancer.

e) A linear regression analysis was conducted to test the relationship between intention to vaccinate and HPV and cervical cancer knowledge. HPV and cervical cancer knowledge served as the dependent variable and intent to vaccinate served as the independent variable. The covariates included were: intent to vaccinate today and intent to vaccinate in the next 12 months with a provider recommendation.

2) DOI correlates of intent to vaccinate today

a) A logistic regression analysis was conducted examining the relationship between prior conditions of the decision-making unit and intent to vaccinate today. Intent to vaccinate today served as the dependent variable and variables that described prior conditions served as the covariates. The covariates included: sexual history, relationship history, family history of cancer, medical history, anal sex, oral sex, STI history, and normative values.

b) A logistic regression was conducted to test the relationship between knowledge and intent to vaccinate. Intent to vaccinate today served as the dependent variable and knowledge served as independent variable of interest, using a knowledge score from 11 survey items.

c) A logistic regression was conducted to test the relationship between characteristics of the decision-making unit and intent to vaccinate today. Intent to vaccinate today served as the dependent variable and variables that described characteristics of the decision-making unit served as covariates. Covariates included were: demographics, socioeconomic status, current relationship, current sexual practices, and STI at baseline.

d) A logistic regression analysis was conducted to test the relationship between characteristics of the decision-making unit and intent to vaccinate today. Intent to vaccinate today served as the dependent variable and variables that described perceived characteristics of the innovation served as covariates. The covariates included were: general vaccine perceptions, HPV vaccine perceptions, and perceived susceptibility and severity to HPV and cervical cancer.

e) A logistic regression analysis was conducted to test the relationship between HPV and cervical cancer knowledge, perceived characteristics of the innovation, and intent to vaccinate today. Intent to vaccinate today served as the dependent variable. The covariates, or independent variables, included were: knowledge, general vaccine perceptions, HPV vaccine perceptions, and perceived susceptibility and severity to HPV and cervical cancer.

3) DOI Correlates of intent to vaccinate in the next 12 months with a provider recommendation

a) Logistic regression analysis was conducted examining the relationship between prior conditions of the decision-making unit and intent to vaccinate in the next 12 months with a provider recommendation. Intent to vaccinate in the next 12 months with a provider recommendation served as the dependent variable and variables that described prior conditions served as the covariates. The covariates included: sexual history, relationship history, family history of cancer, medical history, anal sex, oral sex, STI history and normative values.

b) A linear regression was conducted to test the relationship between knowledge and intent to vaccinate in the next 12 months with a provider recommendation. Intent to vaccinate

in the next 12 months with a provider recommendation served as the dependent variable and knowledge served as independent variable of interest, using a knowledge score from 11 survey items.

c) A linear regression analysis was conducted to test the relationship between characteristics of the decision-making unit and intent to vaccinate in the next 12 months with a provider recommendation. Intent to vaccinate in the next 12 months with a provider recommendation served as the dependent variable and variables that described characteristics of the decision-making unit served as covariates. Covariates included were: demographics, socioeconomic status, current relationship, current sexual practices, and STI at baseline.

d) A linear regression was conducted to test the relationship between characteristics of the decision-making unit and intent to vaccinate in the next 12 months with a provider recommendation. Intent to vaccinate in the next 12 months with a provider recommendation served as the dependent variable and variables that described perceived characteristics of the innovation served as covariates. The covariates included were: general vaccine perceptions, HPV vaccine perceptions, and perceived susceptibility and severity to HPV and cervical cancer.

e) A logistic regression analysis was conducted to test the relationship between HPV and cervical cancer, perceived characteristics of the innovation, and intent to vaccinate in the next 12 months with a provider recommendation. Intent to vaccinate in the next 12 months with a provider recommendation served as the dependent variable. The covariates, or independent variables, included were: knowledge, general vaccine perceptions, HPV vaccine perceptions, and perceived susceptibility and severity to HPV and cervical cancer.

Suggested Analyses for Future Studies

Attributable to the lack of statistical power to analyze the data for predictors of Gardasil vaccination, knowledge and intention to vaccinate were analyzed as dependent variables to test the application of the DOI model to HPV vaccine decision-making. However, if statistical power were sufficient, the same analyses could be conducted to test the DOI model in predicting uptake of the HPV vaccine. Also, both series HPV vaccine series initiation and HPV vaccine series completion could serve as the dependent variables in the process model analyses. Such analyses would expose predictors of both HPV vaccine series initiation and series completion as well as build a model for predictors of HPV vaccine uptake. The analyses would also further test explanatory power of the Innovation-Decision Process model and the DOI preventative innovations model as applied to HPV vaccine uptake.

RESULTS

Description of the Sample

The total sample size included in this analysis was 216 African American adolescent females ages 13 to 18. Of these participants, the mean age was 16.50 (1.50) (Table 1). The majority of participants (143, 66.2%) were recruited from the DeKalb Clinic. With respect to education level, 38 (17.6%) reported 8th grade or less, 44 (20.4%) reported 9th grade, 30 (12.9%) reported 10th grade, 42 (13.0%) reported 11th grade, 28 (13.0%) reported 12th grade, and 34 (15.7%) reported having graduated high school or received a GED. Most participants (116, 53.7%) live only with their mother and 46 (21.3%) live with both parents. About half of the participants receive a form of public assistance (47.7%). Further, 19 (8.8%) have private health insurance, 100 (46.3%) have either Medicaid or GA CHIP, and 38 (17.6%) do not have health insurance.

Of the participants, 164 (75.9%) have had vaginal sex (Table 2). The average age for first having vaginal sex was 15.53 years (2.32). Almost all participants reported usually having sex with men (156, 95.1%). On average participants have had 4.04 (4.83) vaginal sex partners. More than half of the participants (132, 61.1.%) reported being in a romantic relationship with a male (Table 3). Of the participants in a romantic relationship, 23 (16.9%) believe that their partner has had sex with another person. Also, 88 (53%) used a condom at last sex. Forty-three participants (26.2%) have been pregnant. Of the participants, 17 (7.9%) have had anal sex. The mean age for first having anal sex was 15.53 (2.32%).

Table 1. Sociodemographic characteristics

Sociodemographic characteristics	N=216 N (%)
Age (M, SD)	16.5 (1.50)
Clinic	
Carroll	1 (.5%)
Clayton	22 (10.2%)
DeKalb	143 (66.2%)
Fulton	47 (21.8%)
Planned Parenthood	3 (1.4%)
Education Level	
8th grade or less	38 (17.6%)
9th grade	44 (20.4%)
10th grade	30 (13.9%)
11th grade	42 (19.4%)
12th grade	28 (13.0%)
High school grad or GED	34 (15.7%)
Living Situation	
Live alone	4 (1.9%)
Live with both parents	46 (21.3%)
Live with their mother	116 (53.7%)
Live with their father	11 (5.1%)
Live with their boyfriend	8 (3.7%)
Live with other relative	22 (10.2%)
Receives form of Public Assistance	
No	113 (52.3%)
Welfare (TANF, SSI)	18 (8.3%)
Food stamps	99 (45.8%)
WIC	26 (12.0%)
Section 8 housing	10 (4.6)
Currently Employed	34 (15.7%)
Health Insurance	
Private	19 (8.8%)
Medicaid	97 (44.9%)
GA CHIP	3 (1.4%)
No insurance	38 (17.6%)
Don't know	59 (27.3%)

Table 2. Sexual characteristics

Sexual characteristics	N=216 N (%)
Ever had vaginal sex	164(75.9%)
Age at first sex (M, SD)	15.53 (2.32)
Usually have sex with:	
Men	156(95.1%)
Women	1 (0.6%)
Both men and women	7 (4.3%)
Typical age of sex partners:	
Much younger (4+ yrs)	1 (.6%)
Younger (2-3 yrs)	5 (3.0%)
Same age	92 (56.1%)
Older (2-3 yrs)	56 (34.1%)
Much older (4+ yrs)	10 (6.1%)
Lifetime vaginal sex partners (M, SD)	4.04 (4.83)
# Vaginal sex partners in past 90 days (M, SD)	1.38 (1.14)
Ever pregnant	43 (26.2%)
Condom use at last sex	88 (53.7%)
Protection used at last sex (other than condom):	
Pill/patch/depo/ring	39 (23.8%)
Withdrawal	20 (12.2%)
Other	21 (12.8%)
None	94 (57.3%)
# Times had vaginal sex in past 90 days (M, SD)	6.20 (9.99)
# Times condoms used vag. sex past 90 days (M, SD)	2.84 (3.85)
# Times had vaginal sex while high or drunk in past 90 days (M, SD)	0.59 (2.28)
Ever had anal sex	17 (7.9%)
Age at first anal sex (M, SD)	15.53 (2.32)
# Times had anal sex in past 90 days (M, SD)	2.23 (3.82)
# Times used condoms during anal sex past 90 days (M, SD)	1.27 (1.56)
Ever performed oral sex	83 (38.4%)
Age when first performed oral sex (M, SD)	15.84 (1.89)
# Lifetime oral sex partners (M, SD)	2.42 (4.60)
# Times had oral sex in past 90 days (M, SD)	3.59 (6.52)
# Times used condom during oral sex in past 90 days (M, SD)	.89 (1.87)

Additionally, 47 (21.9%) reported that they had previously tested positive for a STI and 47 tested positive for a STI at baseline (23.0%) (Table 3). Of the participants, 25.5% (12) have had more than one positive STI diagnoses. Of the participants, 8 (3.7%) have a family history of cervical cancer. Also, slightly less than half of participants have had a Pap smear (43.5%) with 15 (16.0%) reporting a past abnormal Pap smear.

Table 3. Medical characteristics

Medical characteristics	N=216 N (%)
Family history of any cancer	84 (39.3%)
Family history of cervical cancer	8 (3.7%)
Ever had a Pap smear	94 (43.5%)
Had previous Pap smear (before most recent)	27 (28.7%)
Ever had abnormal Pap smear	15 (16.0%)
Ever had positive HPV diagnosis	2 (2.1%)
Ever tested positive for STI infection	47 (21.9%)
Number of positive STI diagnoses (of those who ever tested positive):	
Once	35 (74.5%)
Twice	8 (17.0%)
Three times	2 (4.3%)
Four or more times	2 (4.3%)
Positive for STI at baseline	47 (23.0%)

Table 4. Relationship characteristics

Relationship characteristics	N=216 N (%)
Currently in romantic relationship with male	132 (61.1%)
Length of current relationship in months (M, SD)	11.18 (11.64)
Time frame for first sex in relationship:	
Haven't had sex yet	31 (22.8%)
Within a month	22 (16.2%)
Less than a month	11 (8.1%)
More than a month	72 (52.9%)
Believes partner has had sex with another person	23 (16.9%)
Has current casual sex partner (in addition to main partner)	33 (15.3%)
Condom use at last sex with casual partner	8 (66.7%)
Believes casual partner has had vaginal sex with another person	11 (33.3%)

The mean score for HPV and cervical cancer knowledge was 4.61 (2.16) out of 12 possible points, indicating a limited knowledge of HPV and cervical cancer infection (Table 5). The mean perceived susceptibility and severity of HPV and cervical cancer infection score was 31.32 (6.26) out of 63, with a greater score indicating greater perceived susceptibility and severity of HPV and cervical cancer. The average vaccine perceptions score was 10.16 (2.76) out of 21, with a greater score indicating greater negative perceptions. The average HPV vaccine perceptions score was 4.76 (1.72) out of 12 indicating relatively positive perceptions of the HPV vaccine. The mean score for normative beliefs for HPV vaccination was 6.61 (2.62) out of 12 indicating a relatively moderate influence to receive the vaccine. Of the participants, 58 (26.9%) reported that they were likely to get the HPV vaccine today. Over half of the participants (136, 63.0%) reported that they were likely to get the HPV vaccine in the next 12 months with a provider recommendation.

Table 5. HPV Vaccine acceptability and beliefs

HPV Vaccine acceptability and beliefs (Range of possible values)	N=216 N (%)
HPV/cervical cancer knowledge (M, SD) (0-11; higher # indicates more responses correct)	4.61 (2.16)
Perceived susceptibility and severity of HPV/cervical cancer (M, SD) (0-63; higher # indicates greater perceived susceptibility)	31.32 (6.26)
Vaccine perceptions (M, SD) (0-21; higher # indicates greater negative perceptions)	10.16 (2.76)
HPV vaccine perceptions (M, SD) (0-12; higher # indicates greater negative perceptions)	4.76 (1.72)
Likely to get HPV vaccine today	58 (26.9%)
Likely to get HPV vaccine in next 12 months with a provider recommendation	136 (63.0%)
Normative Beliefs for HPV vaccination (M, SD) (0-12; higher # indicates greater social and peer influence to receive HPV vaccination)	6.61 (2.62)

Correlates of HPV and cervical cancer knowledge

Pearson correlation analyses and one-way ANOVA analyses were conducted with each proposed predictor variable and the outcome variable, HPV and cervical cancer knowledge, at a bivariate level. Pearson correlations were used to examine the continuous predictor variables. One-way ANOVA analyses were used to examine the categorical independent variables. The proposed predictors that were associated with the outcome variable at $p<.20$ were included in the multivariate linear regression model (Table 6).

Prior conditions and HPV and cervical cancer knowledge

Of all variables measuring prior conditions of the decision making unit, the bivariate analyses suggest that family history of cervical cancer ($p=.089$), ever having a Pap smear ($p=.099$), ever having an abnormal Pap smear ($p=.077$), age at first sex ($p=.085$) , the number of lifetime vaginal sex partners ($p=.057$), the number of vaginal sex partners in past 90 days ($p=.121$), condom use at last sex ($p=.141$), age at first anal sex ($p=.021$), ever testing positive for an STI infection ($p=.003$), having more than one STI diagnosis($p=.049$), and normative beliefs for HPV vaccination ($p=.011$), were independently associated with HPV and cervical cancer knowledge at $p<.20$. Therefore, eleven variables were included in a subsequent linear regression model using the Enter method (Appendix E: Figure 3).

Results of the regression model suggest that no variables were significantly associated with HPV and cervical cancer knowledge when entered into a model (Table 5). Having an abnormal pap smear in the past was moderately associated with HPV and cervical cancer knowledge. Specifically, those who have had an abnormal pap smear in the past had a knowledge score that was .635 points higher than those who did not have an abnormal pap

smear in the past when controlling for other variables in the model (B=.635; CI 95%= -.176, 2.357; p=.090). The total regression model accounted for 20% of the variance in knowledge.

Characteristics of the decision making unit and HPV and cervical cancer knowledge

Of all variables measuring prior conditions of the decision-making unit, the bivariate analyses suggest that age (p=.161), living situation (p=.097), believes partner has had sex with another person (p=.139), and believes casual partner has had sex with another person (p=<.001), were independently associated with HPV and cervical cancer knowledge at p<.20. Therefore, four variables were included in a subsequent linear regression model using the Enter method (Appendix E: Figure 3).

Results of the regression model suggest that living with their mother and those living with a parent were significantly associated with HPV and cervical cancer knowledge (Table 5). Specifically those that live with their mother had a knowledge score that was 4.861 points lower than those who did not live with their mother ((B=-4.861; 95% CI=-8.559, -1.163; p=.014). Also, those that lived with a parent had a knowledge score that was 1.337 points higher than those who did not live with a parent (B=1.337; 95% CI=1.679, 9.259; p=.008). Participant age (p=.761) and believing that their casual partner has had sex with another person (p=.062) were not significantly associated with HPV knowledge. The total regression model accounted for 53% of the variance in HPV and cervical cancer knowledge.

Perceived characteristics of the innovation and HPV and cervical knowledge

Of all variables measuring perceived characteristics of the innovation, the bivariate analyses suggest that perceived susceptibility and severity of HPV and cervical cancer infection (p=.022) is independently, significantly associated with HPV and cervical cancer

knowledge. Therefore, this variable was included in a linear regression model (Appendix E: Figure 3).

Results of the regression model suggest that perceived susceptibility and severity of HPV and cervical cancer infection was significantly associated with HPV and cervical cancer knowledge (Table 6). Specifically, for each unit increase in perceived susceptibility or severity of HPV and cervical cancer infection, knowledge on increased on average by .054 points (B=.054; 95% CI=1.451, 4.389 ; p=.022). The total regression model accounted for 2.4% of variance in HPV knowledge.

Intent to vaccinate and HPV and cervical cancer knowledge

Both intent to vaccinate today and intent to vaccinate within 12 months with a provider recommendation were analyzed at the bivariate level with HPV and cervical cancer knowledge. The bivariate analyses suggest that intent to vaccinate in the future with a provider recommendation (p=.042) is independently, significantly associated with HPV and cervical cancer knowledge. Therefore, this variable was included in a linear regression model. Results of the regression model suggest that intention to vaccinate in the future was not significantly associated with HPV and cervical cancer knowledge (p=.416) (Table 6).

Table 6. Correlates of HPV and cervical cancer knowledge*

Correlates of HPV and cervical cancer knowledge	Beta	Significance level	Confidence interval (95%)
Prior conditions			
Abnormal Pap smear	.635	p=.090	-.176, 2.357
Characteristics of the decision-making unit			
Lives with mother	-4.861	p=.014	-8.559, -1.163
Lives with parent	1.337	p=.008	1.679, 9.259
Perceived characteristics of the innovation			
Perceived susceptibility and severity of HPV and cervical cancer infection	.054	p=.022	1.451, 4.389
Intent to vaccinate			
Intent to vaccinate within 12 months with a provider recommendation		p=.416	

*Variables that reached significance (p<.05) or approached significance were included in the table

Correlates of intent to vaccinate today

Independent t-tests and chi-square analyses were conducted with each proposed predictor variable and the outcome variable, intention to vaccinate today, at a bivariate level. Independent t-tests were used to examine the continuous predictor variables. Chi-square analyses were used to examine the categorical independent variables. The proposed predictors that were associated with the outcome variable at p<.20 were included in the bivariate logistic regression model (Table 7).

Prior conditions and intent to vaccinate today

Of all variables measuring prior conditions of the decision-making unit, the bivariate analyses suggest that ever having a pap smear (p=.075), having previous pap smear (before the most recent) (p=.159), having an STI at baseline (p=.046), having had more than one STI (p=.140), and normative beliefs (p=.001) were independently associated with intention to vaccinate today at p<.20. Therefore, five variables were included in a bivariate logistic regression model using the Enter method (Appendix E: Figure 4).

Results of the regression model suggest that having had more than one STI was significantly associated with intention to vaccinate today (Table 6). Specifically, those who report having had more than one STI are 29 times more likely to have the intention to vaccinate today (AOR=28.917; 95% C=2.287, 365.600; p=.009). Ever having a pap smear (p=.729), having a previous pap smear (before the most recent) (p=.078), having at STI at baseline (p=.479), and normative beliefs (p=.874) were not significantly associated with intention to vaccinate today.

Characteristics of the decision-making unit and intent to vaccinate today

Of all variables measuring characteristics of the decision-making unit, the bivariate analyses suggest that education level (p=.169), living with mother (p=.111), health insurance type (p=.092), and believes partner has had sex with another person (p=.038) were independently associated with intention to vaccinate today at p<.20. Therefore, four variables were included in a bivariate logistic regression model using the Enter method (Appendix E: Figure 4).

Results of the regression model suggest that having an education level of 8th grade or less and having an education level of 9th grade are significantly associated with intention to vaccinate today (Table 7). Specifically, those that have an education of 8th grade or less are 7.9 times more likely to have the intention to vaccinate today (AOR=7.850; 95% CI= 1.267, 48.625; p=.027). Also, those with a 9th grade education level are 7.7 times more likely to have the intention to vaccinate today (AOR=7.713; CI 95% 1.214, 49.018; p=.030). Living situation (p>.05), health insurance (p=.461), and believing your partner has had sex with another person (p=.114) were not significantly associated with intention to vaccinate today.

Perceived characteristics of the innovation and intent to vaccinate today

Of all variables measuring perceived characteristics of the innovation, the bivariate analyses suggest that vaccine perceptions (p=.149) and HPV vaccine perceptions (p=.114) were independently associated with intention to vaccinate today at p<.20. Therefore, two variables were included in a bivariate logistic regression model using the Enter method (Appendix E: Figure 4).

Results of the regression model suggest that HPV vaccine perceptions were significantly associated with intention to vaccinate today (Table 7). Specifically, for each unit increase in negative HPV vaccine perceptions, the odds having the intention to vaccinate today increases by 1.235 (AOR= 1.235; 95% CI=1.017, 1.499; p=.033). General vaccine perceptions were not significantly associated with intention to vaccinate today (p=.059).

HPV and cervical cancer knowledge and intent to vaccinate today

An independent t-test was conducted to examine the bivariate relationship between HPV and cervical cancer knowledge and intention to vaccinate today. The bivariate analysis suggests that knowledge (p=.067) is independently associated with intention to vaccinate today at p<.20. Therefore, knowledge was included in a bivariate logistic regression model using the Enter method (Appendix E: Figure 4).

Results of the regression model suggest that HPV and cervical cancer knowledge was only moderately significantly associated with intention to vaccinate today (Table 7). Specifically, for each unit increase in knowledge, the odds of odds of having the intention to vaccinate today increases by 1.144 (AOR=1.144; CI 95%= .990, 1.322; p=.068).

HPV and cervical cancer knowledge, characteristics of the innovation and intent to vaccinate today

Due to theoretical significance and following the DOI process model, HPV and cervical cancer knowledge and perceived characteristics of the innovation that were significantly associated with future intention to vaccinate at the bivariate level were included in a logistic regression. Of all variables measuring perceived characteristics of the innovation, the bivariate analyses suggest that vaccination barriers (p=.149) and HPV vaccination barriers (p=.114) were independently associated with intention to vaccinate today at p<.20. Therefore, three variables were included in a bivariate logistic regression model using the Enter method.

Results of the logistic regression suggest that, general vaccine perceptions, HPV vaccine perceptions, and HPV and cervical cancer knowledge were significantly associated with intention to vaccinate today (Table 7). For each unit increase in negative general vaccine perceptions, the odds of having the intention to vaccinate today decrease by .878 points (AOR= .878; 95% CI=.773, .998 ; p=.047). For each unit increase in negative HPV vaccine perceptions, the odds of having the intention to vaccinate today increase by 1.260 (AOR= 1.260; 95% CI=1.036, 1.533; p=.021). For each unit increase in HPV and cervical cancer knowledge, the odds of having the intention to vaccinate today increase by 1.167 (AOR=1.167; 95% CI=1.007, 1.353; p=.040).

Table 7. Correlates of intent to vaccinate today*

Correlates intent to vaccinate today	Adjusted Odds Ratio	Significance level	Confidence interval (95%)
Prior conditions			
More than one STI	28.917	p=.009	2.287, 365.600
Characteristics of the decision-making unit			
8th grade education level or less	7.850	p=.027	1.267, 48.625
9th grade education level	7.713	p=.030	1.214, 49.018
Perceived characteristics of the innovation			
Perceived HPV vaccination barriers	1.235	p=.033	1.017, 1.499
Knowledge			
HPV and cervical cancer knowledge	1.144	p=.068	.990, 1.322
Knowledge & perceived characteristics of the innovation			
Vaccine perceptions	.878	p=.047	.773, .998
HPV vaccine perceptions	1.260	p=.021	1.036, 1.533
HPV and cervical cancer knowledge	1.167	p=.040	1.007, 1.353

*Variables that reached significance (p<.05) or approached significance were included in the table

Correlates of intent to vaccinate in the next 12 months with a provider recommendation

Independent t-tests and chi-square analyses were conducted with each proposed predictor variable and the outcome variable, intention to vaccinate with a provider recommendation within 12 months, at a bivariate level. Independent t-tests were used to examine the continuous predictor variables. Chi-square analyses were used to examine the categorical independent variables. The proposed predictors that were associated with the outcome variable at p<.20 were included in the bivariate logistic regression model (Table 8).

Prior conditions and future intent to vaccinate

Of all variables measuring prior conditions of the decision-making unit, the bivariate analyses suggest that ever having a Pap smear (p<.001), ever having vaginal sex (p=.058), number of lifetime vaginal sex partners (p=.001), ever being pregnant (p=.198), condom use at last sex (p=.134), using the pill, patch, depo, or ring at last sex (p=.048), the number of

times having had vaginal sex in past 90 days (p=.126), the number of times having had vaginal sex while high or drunk in past 90 days (p=.098), the number of times having used condoms during anal sex past 90 days (p=.178), ever performed oral sex (p=.025), ever tested positive for STI infection (p<.001), more than one STI diagnoses (p=.166), and normative beliefs (p<.001) were independently associated with intention to vaccinate with a provider recommendation within 12 months at p<.20. Therefore, thirteen variables were included in a bivariate logistic regression model using the Enter method (Appendix E: Figure 5).

Results of the regression model suggest that normative beliefs are significantly associated with future intention to vaccinate (Table 8). For each unit increase in normative beliefs to vaccinate, the odds of having the future intention to vaccinate increased by 1.413. (AOR=1.413; CI 95%= 1.173, 1.702, p<.001). The other variables entered into the model were not significantly associated with future intention to vaccinate.

Characteristics of the decision-making unit and future intent to vaccinate

Of all variables measuring prior conditions of the decision-making unit, the bivariate analyses suggest that participant age (p<.001), education level (p=.012), living with mother (p=.193), health insurance type (p=.179), believes partner has had sex with another person (p=.099), has current casual sex partner (in addition to main partner) (p=.015), and believes casual partner has had vaginal sex with another person (p=.077) were independently associated with intention to vaccinate with a provider recommendation within 12 months at p<.20. Therefore, seven variables were included in a bivariate logistic regression model using the Enter method (Appendix E: Figure 5).

Results of the regression model suggest that no variables were significantly associated with future intention to vaccinate when entered into a model (Table 8). Those who believe their partner has had sex with another person are 61% less likely to have the intention of vaccinating in the future (AOR= .386, CI 95%= .141, 1.058; p=.064). Results of the regression model suggest that no variables entered into the model were significantly associated with future intention to vaccinate. Believing that your partner has had sex with another person was moderately significantly associated with future intention to vaccinate.

Perceived characteristics of the innovation and future intent to vaccinate

Of all variables measuring prior conditions of the decision-making unit, the bivariate analyses suggest that vaccine perceptions (p=.065) and HPV vaccine perceptions (p<.001) were independently associated with intention to vaccinate with a provider recommendation within 12 months at p<.20. Therefore, two variables were included in a bivariate logistic regression model using the Enter method (Appendix E: Figure 5).

Results of the regression model suggest that HPV vaccine perceptions were significantly associated with future intention to vaccinate (Table 8). For each unit increase in negative HPV vaccine perceptions, the odds of having the intention to vaccinate in the future decrease by .674 (AOR= .674; 95% CI=.554, .820; p<.001). However, general vaccine perceptions was not significantly associated with future intention to vaccinate (p=.664).

HPV and cervical cancer knowledge and future intent to vaccinate

An independent t-test was conducted to examine the bivariate relationship between knowledge and intention to vaccinate with a provider recommendation within 12 months.

The bivariate analysis did not suggest that knowledge (p=.416) is independently, significantly associated with intention to vaccinate with a provider recommendation within 12 months. However, due to theoretical significance and following the DOI process model this variable was included in a logistic regression model (Appendix E: Figure 3). Results of the regression model suggest that knowledge (p=.414) is not significantly associated with future intention to vaccinate when entered into a model (Table 8).

HPV and cervical cancer knowledge, perceived characteristics of the innovation, and future intent to vaccinate

Due to theoretical significance and following the DOI process model, HPV and cervical cancer knowledge and perceived characteristics of the innovation that were significantly associated with future intention to vaccinate at the bivariate level were included in a logistic regression. Of all variables measuring perceived characteristics of the decision making unit, the bivariate analyses suggest that general vaccine perceptions (p=.065) and HPV vaccine perceptions (p<.001) were independently associated with intention to vaccinate with a provider recommendation within 12 months at p<.20. Therefore, three variables were included in a bivariate logistic regression model using the Enter method.

Results of the logistic regression suggest that HPV vaccine perceptions are significantly associated with future intention to vaccinate (Table 8). For each unit increase in negative HPV vaccine perceptions, the odds of having the intention to vaccinate in the future decrease by .676 points (AOR=.676; CI 95%=.908, 1.187; p<.001). General vaccine perceptions (p=.652) and HPV and cervical cancer knowledge (p=.583) were not significantly associated with future intention to vaccinate.

Table 8. Correlates of intent to vaccinate in the next 12 months with a provider recommendation*

Correlates intent to vaccinate in the next 12 months with a provider recommendation	Adjusted Odds Ratio	Significance level	Confidence interval (95%)
Prior conditions			
Normative HPV beliefs	1.413	p<.001	1.173, 1.702
Characteristics of the decision-making unit			
Believes partner has had sex with another person	.386	p=.064	.141, 1.058
Perceived characteristics of the innovation			
HPV vaccine perceptions	.674	p<.001	.554, .820
Knowledge			
HPV and cervical cancer knowledge		p=.414	
Knowledge & perceived characteristics of the innovation			
HPV vaccine perceptions	.676	p<.001	908, 1.187

*Variables that reached significance (p<.05) or approached significance were included in the table

DISCUSSION

Summary

In the United States, rates of HPV related cancers and deaths caused by HPV related cancers are higher among African American women when compared to other racial or ethnic groups, particularly in the south [19] [3]. Moreover, HPV infection prevalence among African American adolescent females is greater than non-Hispanic whites [13]. Despite the development of a safe and effective vaccine, HPV vaccination rates remain low among African American adolescent females, a population undeniably at greater risk [3] [41] [18] [17] [24] [44] [45] [22]. While there is a growing field of research related to adolescent HPV vaccine acquisition, vaccine promotion among African American adolescent females remains unsuccessful. This is a result of an inadequate understanding of the factors that are associated with HPV vaccination uptake among this group [44]. Research is needed to expose the reasons for under vaccination among African American adolescents. If the poor vaccination rates are not understood and addressed among this population, the existing racial/ethnic and geographic disparities will widen. As demonstrated by the literature, there is an urgent need for theoretically driven strategies to increase HPV vaccine uptake among adolescent minorities.

In response to this need for an improved theoretical model to conceptualize HPV vaccine decision-making among African American adolescent females, this study applied Everett Rogers' Diffusion of Innovations Theory (DOI) to the HPV vaccine, an innovation in preventative health [1]. This was the first quantitative research study to examine the explanatory power of DOI as it relates to HPV vaccination. The purpose of this research was to explain HPV vaccine decision-making among African American adolescent females using

DOI. The analyses conducted in this study identified statistically significant correlates of HPV knowledge and intent to vaccinate against HPV following the DOI model constructs: prior conditions, characteristics of the decision-making unit, and perceived characteristics of the innovation. This research also tested the explanatory power of the DOI Innovation-Decision Process model and the DOI preventative innovations model as it relates to HPV vaccine decision-making. From the results of this research, it is evident that the DOI framework is an appropriate theoretical model to conceptualize and examine HPV vaccine uptake among African American adolescent females.

The results of this study answered the three research questions as follows:

Research Question 1: What are correlates of HPV knowledge and intention to vaccinate against HPV among African American adolescent females?

This study identified correlates of HPV knowledge and intention to vaccinate against HPV among African American adolescent females, following the DOI Innovation-Decision Process model. The results of the regression analyses exposed characteristics of prior conditions, characteristics of the decision making unit, and perceived characteristics of the innovation that were correlates of HPV knowledge and intention to vaccinate against HPV (Tables 6-8) (Appendix E: Figures 6-7).

HPV and cervical cancer knowledge.

When controlling for other prior condition variables, reporting a past abnormal Pap smear was correlated with HPV and cervical cancer knowledge. Adolescents who had an abnormal Pap smear knew more about HPV and cervical cancer. Greater knowledge of HPV and cervical cancer among individuals with past abnormal Pap smears is most likely the

result of receiving information from their health care provider on HPV and cervical cancer upon getting the results of their Pap smear. Health care providers are likely to educate adolescents who have abnormal Pap smears on such topics being that that an abnormal Pap smear can be caused by HPV or the presence of cancerous cells, such as cervical cancer. This finding illustrates the important role of health care providers as educators regarding HPV and cervical cancer [21 17 65 20 33 18 56 57]. It is imperative that health care providers educate all adolescents rather than those that may already have HPV or appear to be at the most risk of getting HPV or cervical cancer.

Two variables measuring characteristics of the decision-making unit were statistically significant correlates of HPV and cervical cancer knowledge: living with their mother and living with a parent. This research suggests that adolescents that only live with their mother have less knowledge about HPV and cervical cancer. Conversely, those that reported living with a parent (mother, father, or both), have greater HPV and cervical cancer knowledge. These findings suggest that the father or living with both parents positively influences adolescent knowledge of HPV and cervical cancer. It is probable that living with both parents allows for more hands on parenting and consequently, transfer of knowledge opportunities, relating to important adolescent health issues. It is also possible that the father has a role in educating on health topics such as HPV. However, more research is needed to better understanding the role of the parents in HPV and cervical cancer knowledge [55 56 21].

Regarding participant perceptions of characteristics of the innovation, greater perceived susceptibility and severity to HPV and cervical cancer was significantly associated with having greater knowledge of HPV and cervical cancer. This finding suggests that individuals who feel that they are more likely to get HPV or cervical cancer have more

knowledge on the topic. Also, adolescents who feel that HPV or cervical cancer is more of a threat to their life and wellbeing have greater knowledge on the topic. Being that both knowledge and perceived susceptibility and severity have been linked to intention to vaccinate and vaccine acquisition in the literature, vaccine promotion strategies, and specifically messaging, should focus on increasing perceived susceptibility and severity to HPV and cervical cancer among African American adolescents [54 14 40 13 65 33 22 66 56 18 46]. By increasing adolescent knowledge through messaging that stresses adolescent susceptibility and severity to HPV, adolescents will be more likely to get the vaccine. Notably, perceptions of the vaccines and perceptions of the HPV vaccine were not correlated with knowledge. Therefore, in addition to improving perceptions of the HPV vaccine among adolescents, it is also critical to emphasize the susceptibility and severity of HPV itself.

Intent to vaccinate today

When controlling for other variables measuring the construct of prior conditions, having more than one past STI diagnosis was strongly associated with the intention of vaccinating at baseline. This was the only statistically significant prior condition that correlated with having the intention to vaccinate that day. This finding suggests that individuals that have experienced negative health consequences as a result of risky sexual behavior are more likely to exhibit protective health behaviors in that they intend to become vaccinated against HPV. This is not consistent with previous research that has found that individuals who are more sexually risky are less likely to vaccinate [61]. This study found that individuals who have had more than one past experience with an STI want to get the HPV vaccine in order to protect themselves from another STI. While such protective health

behavior among an at-risk group is positive, a more preventative approach should be assumed in respect to promoting the vaccine. Public health professionals and health promotion strategies should encourage protective behaviors, like vaccination against HPV, to all adolescents, not just those who are the most risk for contracting HPV.

When controlling for other variables measuring characteristics of the decision-making unit, individuals with a 9th grade education or less were more likely to report having the intention of vaccinating against HPV that day. This result contradicts conclusions in the literature that show that a higher level of education or being older is associated with intention to vaccinate and vaccine acquisition [14 18]. Such findings could be explained by the fact that reporting the intention to vaccinate is a socially desirable answer and younger individuals, such as those in the 9th grade or below, are more likely to be biased by social desirability. This inconsistency with the literature demonstrates the need for further research to better understand the relationship between level of education and intention to vaccinate.

Reporting negative HPV vaccine perceptions was the one statistically significant perceived characteristic of the innovation that was associated with intention to vaccinate. Specifically, results of this research indicate that individuals who expressed negative HPV vaccine perceptions were less likely to have the intention of getting the vaccine that day. In effect, individuals with more negative vaccination perceptions were less likely to have the intention of vaccinating that day adolescents [54 14 40 13 65 33 22 67 56 18 46]. These results demonstrate that HPV vaccine promotion approaches should seek to foster positive perceptions of the HPV vaccine among African American adolescent females. Such strategies should stress the relative advantage of the vaccine, as Rogers' model for preventative innovations posits [25]. With this, messaging should focus on the benefits of the

vaccine and seek to eliminate any perceived risks or barriers related to vaccination adolescents [54 14 40 68 65 33 22 51 56 18 46]. Notably, negative perceptions of vaccines in general were not associated with intention to vaccinate against HPV. This finding suggests that intention to vaccinate against HPV is not influenced by general vaccine perceptions but HPV vaccine perceptions. Therefore, strategies to increase HPV vaccination uptake should specifically focus on strengthening perceptions of the HPV vaccine.

Lastly, HPV and cervical cancer knowledge was significantly associated with reporting the intent to vaccinate that day. Findings from the analyses suggest that having greater knowledge of HPV and cervical cancer increases the likelihood of wanting to get vaccinated against HPV. This finding is concurrent with previous studies that have consistently found that knowledge is not only associated with intention to get the vaccine, but a predictor of vaccine acquisition among adolescents [55 21 14 40 44 51 56 42]. It is imperative that HPV vaccine promotion strategies seek to increase adolescent HPV and cervical cancer knowledge. With that said, increasing knowledge requires a greater understanding of the factors that influence HPV and cervical cancer knowledge, as well as strategies that target such factors. For example, in order to increase knowledge among African American adolescents, strategies should consider factors found in this study associated with knowledge such as stressing the one's susceptibility to and severity of HPV and cervical cancer.

Intent to vaccinate in the next 12 months with a provider recommendation

When controlling for other prior conditions of the decision-making unit, reporting normative beliefs supporting vaccination was the only factor associated with intention to vaccinate in the next 12 months with a provider recommendation. Individuals who reported

having normative beliefs supporting the HPV vaccination were more likely to have the intention of vaccinating in the future. This finding demonstrates the influence of intrapersonal relationships and social contexts in relation to HPV vaccine decision-making. Individuals who feel that their family, peers, and health care provider are supportive of the HPV vaccine are more likely to want to vaccinate in the future. This finding is consistent with existing research in the field of HPV vaccination [57 49 56 18 20 40]. The results demonstrate that HPV vaccine decision-making is not isolated from social contexts and influence. As a result, interventions to improve HPV vaccination among adolescents should not be conducted merely at the individual level. It is essential that HPV vaccine promotion approaches reach the family members and peers of adolescents so that they have positive normative beliefs regarding vaccination. Just as important, both the literature and findings from this study indicate that health care providers play a critical role in HPV vaccine decision-making. Future strategies to increase vaccine uptake must involve health care providers in encouraging the vaccine and fostering positive normative beliefs and perceptions of the vaccine among adolescents.

In respect to characteristics of the decision making unit, adolescents that reported believing that their sexual partner has had sex with another person was the factor that was significantly associated with having the intention to vaccinate in the next 12 months with a provider recommendation. This finding demonstrates that individuals who perceive that they are at risk for contracting an STI like HPV from their partner have the intention to get vaccinated in the future. Adolescents that perceive that they are susceptible to HPV as a result of outside risk are more likely to have the intention of protecting themselves against HPV, in response [54 14 40 13 65 33 22 51 56 18 46]. While such protective health behavior among an

at-risk group is positive, a more preventative approach should be assumed in respect to promoting the vaccine. Public health professionals and health promotion strategies should encourage protective behaviors, like vaccination against HPV, to all adolescents, not just those who are the most risk for contracting HPV.

When examining perceived characteristics of the innovation, negative HPV vaccine perceptions was the statistically significant factor correlated with intention to vaccinate in the future. Adolescents who reported negative perceptions of the HPV vaccination were more likely to have the intention of vaccinating in the next 12 months with a provider recommendation. The results of this study demonstrate that adolescents with fewer negative perceptions were more likely to report the intention of getting the vaccination that day, while those with greater negative perceptions were more likely to report the intention to vaccinate in the future with support from the provider. Negative perceptions of the HPV vaccine delay intention to get vaccinated among adolescents. In effect, the results of this study demonstrate the importance of fostering positive perceptions of HPV vaccination and eliminating barriers to vaccination [56 55 54 14 40 18 51]. In doing so, adolescent females would be more likely to get vaccinated against HPV without delay. Further, having negative perceptions of vaccines in general was not associated with intention to vaccinate. This finding suggests that intention to vaccinate against HPV is not influenced by general vaccine perceptions but HPV vaccine perceptions. Therefore, strategies to increase HPV vaccination uptake should specifically focus on strengthening perceptions of the HPV vaccine.

It is important to note that HPV and cervical cancer knowledge was not significantly correlated with intent to vaccinate in the next 12 months with a provider recommendation. The results of this study show that while knowledge is associated with intention to vaccinate

today, it is not associated with future intention to vaccinate. This indicates that in order to promote more immediate vaccination, strategies should focus on increasing HPV and cervical cancer knowledge among African American adolescent females.

Research Question 2: Can components of the DOI Innovation-Decision Process model explain HPV knowledge and intention to vaccinate against HPV among African American adolescent females?

According to Rogers', the Innovation-Decision Process model conceptualizes the mental process through which an individual passes to make a decision about the adoption of an innovation, which in this study is the HPV vaccine [1]. The prior conditions and characteristics of the decision-making unit, as well as their perceived characteristics of the innovation influence the individual's knowledge of the innovation and their decision to ultimately adopt or reject the innovation [1]. This study tested whether the DOI Innovation-Decision Process model can be applied to examine HPV vaccine decision-making.

The results of this study suggest that the DOI Innovation-Decision Process model is an appropriate theoretical framework to analyze and explain HPV knowledge and intent to vaccinate against HPV among African American adolescent females. This is evident due to the fact that this study effectively measured the constructs and characteristics of the DOI Innovation-Decision Process model and successfully conducted regression analyses following the process model to test for significant correlates of HPV knowledge and intent to vaccinate against HPV (Appendix E: Figures 6-7). The results of this study support that the DOI constructs can be operationalized and that a process model analysis can be conducted. Further, the results of this study demonstrate that the DOI process model is able to

incorporate and analyze many variables associated with HPV vaccine decision-making into one framework. Variables that operationalized and measured prior conditions, characteristics of the decision making unit, perceived characteristics of the innovation, knowledge, and intent to vaccinate were all incorporated into one framework (Appendix E: Figures 6-7). The broad nature of the DOI model can effectively parse out the various and diverse factors that influence HPV vaccine uptake.

It is important to note that this study did not examine HPV vaccine uptake or adoption as Rogers' Innovation-Decision Process model intends. Instead, this study examined the individual's intent to vaccinate, at the time of clinic visit and in the future with a provider recommendation, as the outcome variable. Future analyses should be conducted to test the model's explanatory power regarding HPV vaccine uptake, both series initiation and series completion. Nevertheless, the findings from this study suggest that this model and methodology can appropriately conceptualize and explain HPV vaccine uptake.

The results of this study support that the Innovation-Decision Process model is a viable model to conceptualize, conduct analyses, and examine correlates of HPV and cervical cancer knowledge and intention to vaccinate against HPV. In conclusion, the results of this study should encourage future research to better understand the explanatory power of DOI as it relates to HPV vaccine decision-making and to use DOI as a theoretical foundation in HPV vaccine uptake research.

Research Question 3: Can components of the DOI model for preventative innovations explain HPV knowledge and intention to vaccinate against HPV among African American adolescent females?

Following Rogers' DOI model for preventative innovations, perceived characteristics of the innovation are the most important factors influencing an individual's decision to adopt or reject a preventative innovation, like the HPV vaccine [25]. The findings of this research support Rogers' model for preventative innovations. The results of the analyses conducted demonstrate that vaccine perceptions were a statistically significant correlate of intention to vaccinate (Appendix E: Figures 6-7). Vaccine perceptions were associated with intention to vaccinate at the time of clinic visit and in the future with a provider recommendation. The findings are consistent with Rogers' preventative model in that they underscore that the perceptions of the innovation are an important factor associated with the decision to adopt or reject the innovation.

However, the results present some inconsistencies with Rogers' model for preventative innovations. First, the influence, or type of relationship, between vaccine perceptions and intent to vaccinate was not the same between intent to vaccinate today and in the future. While having negative HPV vaccine perceptions decreased the likelihood of having the intention to vaccinate that day (AOR=.674), having negative HPV vaccine perceptions increased the likelihood of having the intention to vaccinate in the future with receipt of provider recommendation (AOR=1.235) (Tables 7-8) (Appendix E: Figures 6-7). Although this possibly deviates from the preventative model, it is likely a result of analyzing intent to vaccinate as the outcome rather than uptake as the model intends. Further research is needed to understand the role of vaccine perceptions and their influence on when individuals

intend to get the vaccine. Another inconsistency is that the prior conditions of the individual and characteristics of the decision-making unit were also strongly associated with intent to vaccinate in addition to perceptions of the innovation. While the model stresses that perceptions of the innovation explain the adoption of the preventative innovation, the results of this study show that intent to vaccinate against HPV is also influenced by several prior conditions and characteristics of the individual.

Additionally, it is important to note that the understanding of the model for preventative innovations as it relates to HPV vaccination is limited due to the fact that this construct could not be fully operationalized as the model intends. The variables in the ACASI survey were not designed to specifically measure Rogers' perceived characteristics of the innovation such as relative advantage, complexity, and compatibility. In the future, measures need to be designed specifically to measure perceptions of the innovation as outline by Rogers model. The findings underscore that in order to understand HPV vaccine decision-making using the model for preventative innovations, future research should examine uptake rather than intention to vaccinate and design measures using the model constructs.

Strengths and Limitations

Strengths

The principal strength of this research was its innovativeness. This was the first quantitative study that applied DOI to conceptualize, examine, and understand HPV vaccine decision-making. In effect, this study filled an important gap in public health research, particularly in the areas of vaccine uptake, adolescent minority health, and sexual and reproductive health. This is especially true being that the existing research in this field is

often critiqued for being a-theoretical or for using theoretical frameworks that are far too narrow to fully understand all factors that influence HPV vaccine decision-making among adolescents [40]. Further, this was the first quantitative study to test the effectiveness of both the DOI Innovation-Decision Process model as well as Rogers' model for the preventative innovations as they relate to HPV vaccine uptake. The results of this study are encouraging. From this research, it is evident that the DOI Innovation-Decision Process model, coupled with the model for preventative innovations can serve as an improved theoretical foundation to frame HPV vaccine uptake. Future research, both observational and experimental, should be conducted using DOI as a theoretical backbone.

Another strength of this study was that the majority of the survey items and scales used in the ACASI survey were previously used and validated in past HPV vaccination studies or adolescent sexual health studies. Applying DOI to HPV vaccination is an innovative manner of measuring and understanding HPV vaccination uptake but being that this was the first study to attempt to do so, coupled with no literature on predictors of HPV vaccination uptake and the innovation-decision process constructs, the measures used were sufficient to test the model and answer the questions of this study. In addition, Cronbach alpha scores demonstrated the internal consistency and reliability of the scales used. Also, ACASI survey items were not mapped to more than one construct.

Another methodological strength of the study was that outside behavioral researchers familiar with operationalizing measures and DOI confirmed that the items accurately measured the theoretical constructs of the Innovation-Decision Process model. Such confirmation improved the validity of measures. Lastly, as demonstrated by the literature review, the existing research on correlates of HPV vaccine attitudes, beliefs, knowledge,

intention, and uptake among adolescents indicates that factors influencing HPV vaccine decision-making can me matched to the constructs of the Theory of Diffusion of Innovations.

Limitations

As with any study, there were several limitations to this research. The relatively small sample size (n=216) was a notable drawback to this study. The small sample size resulted from challenges with recruitment. Few eligible African American adolescent females frequented the participating health clinics during business hours when research staff members were recruiting study participants. Moreover, bus routes were modified during the recruitment period, presenting a barrier for eligible adolescents to travel to the health clinics during business hours. Also, female African American adolescents in the Metropolitan Atlanta area commonly receive health services at a teen clinic that did not participate in this study, decreasing the number of eligible female adolescents visiting the participating health clinics.

The small sample size produced several limitations to this research. A significant limitation caused by a small sample size was that there was not sufficient statistical power to perform the required analyses to examine HPV vaccine uptake as the main predictor variable. Instead, intention to vaccinate substituted vaccine uptake, or vaccine adoption in the DOI model. This study used two items measuring intent to vaccinate against HPV. Rogers developed DOI, and the Innovation-Decision Process model, to explain and predict adoption of an innovation, or in this case, HPV vaccine uptake. Examining intent to vaccinate rather than vaccine uptake deviates from the theoretical model. Further, measuring intent to vaccinate is an item that results in social desirability bias, especially among a young sample.

Additionally, due to narrow eligibility criteria and characteristics of the sample, this study is generalizable to African American adolescent females who are already seeking reproductive health or STI services. Recruitment was conducted at STI and reproductive health clinics; as a result, the results are generalizable to African American females who are sexually active and who are to have likely engaged in sexual risk taking behavior. Moreover, this study was only conducted in clinics in Atlanta, Georgia where there was no cost for vaccination and parental consent for HPV vaccination was not required. Therefore, cost and parental consent as factors influencing HPV vaccination decision-making were eliminated.

Using secondary data from a previously designed survey inhibited this study. The primary study, Girls OnGuard, was designed following the Information Motivation Behavior (IMB) model. Due to the pre-existing theoretical basis, the items measured in the ACASI survey do not correspond to the constructs the DOI model Innovation-Decision Process model but rather the constructs from IMB and other health behavior theories such as the Health Belief Model (HBM). As a result, in order to answer the research questions for this study, the survey items were mapped to the best fitting DOI constructs. With this said, the items measured in the Girls OnGuard survey correspond particularly well with the DOI model. Prior conditions, characteristics of the decision-making unit, and HPV and cervical cancer knowledge were measured in the survey with adequate items and scales. However, the survey was not representative of all DOI constructs. The perceived characteristics of the innovation, was not measured as intended by Rogers. In effect, the reliability and validity of the measures as they pertain to DOI is uncertain.

Another important limitation to note is that each measure relies solely on self-report, which presents an issue of bias. This is particularly true for more sensitive items such as

sexual behavior and sexual history. Also, several measures, such as those related to sexual behavior and sexual history may be influenced by social desirability bias due to the sensitivity of the items. Despite the limitations present in this study, the findings have important implications for future pubic health research and health promotion.

Implications for Public Health Practice

The results of this study have important implications for increasing adolescent HPV vaccine acquisition, and as a result, decreasing HPV related cancer incidence. The promising findings from this study, despite limitations, have the potential to influence health research and health promotion strategies aimed at increasing HPV vaccination, particularly among African American adolescent females. It is without doubt that HPV poses a significant public health threat. In particular, HPV prevalence among African American female adolescents is disproportionately high in comparison to other age groups and ethnic groups. Further exacerbating this problem, HPV vaccination series initiation and completion rates are very low among African American adolescents.

This research establishes that DOI is an appropriate comprehensive theoretical model to explain and understand HPV vaccine decision-making. Using a more robust theoretical framework, like the DOI Innovation-Decision Process model, public health researchers and practitioners can better expose and examine the various factors that influence HPV vaccine adoption or rejection. With this improved understanding, public health professionals can therefore develop, test, and implement enhanced intervention strategies to increase HPV vaccine acquisition among at risk populations like African American females. Such strategies

can increase HPV vaccination and therefore considerably reduce HPV related cancer incidence.

In using DOI to conceptualize and examine HPV vaccine decision-making, theoretically based interventions and programs can be created and tested in order to increase HPV vaccination acquisition among at risk populations such as African American adolescent females. This study in particular elucidated factors associated with HPV knowledge and intention to vaccinate. The results of this research demonstrate that future HPV vaccination strategies should focus on improving and increasing HPV and cervical cancer knowledge, improving perceptions of the HPV vaccine, fostering social support and positive normative beliefs surrounding vaccination, and stressing the individual's susceptibility to HPV and the severity of HPV and cervical cancer. In effect, future research and health promotion approaches should consider such findings.

Notably, this research has very important implications for the Theory of Diffusion of Innovations, particularly the Innovation-Decision Process model and the theory as applied to the model for preventative innovations. Although the Theory of Diffusion of Innovations has never been applied quantitatively to explain HPV vaccination, it is evident that previous theoretical frameworks and studies have been unable to fully integrate all predictors of HPV vaccination into one model. The positive findings from this study indicate that DOI can be applied to HPV vaccine decision-making. As a result, this model can service as a framework to understand HPV vaccine acquisition and create theoretically grounded strategies to increase the diffusion of the HPV vaccine among, accounting for all factors and dynamics that influence vaccine uptake.

Further, there is a considerable amount of research examining the correlates of intentions to receive the HPV vaccine and more recently correlates of vaccine uptake and series completion but research is still very sparse. Findings of existing research are rather disparate, a-theoretical, and are limited, due to the fact that they do not take into account the broad range of constructs that make up the vaccine adoption process. In effect, this research, using DOI, fills an important gap in HPV vaccination research. Moreover, there are few interventions targeting HPV vaccination among adolescents, and in particular, African American adolescents, despite the racial disparities in HPV prevalence and HPV vaccine uptake among this population. Therefore, this study can help to frame interventions and programs for a vulnerable and at-risk population.

This study has enlightening implications for public health being that testing a comprehensive model like DOI to conceptualize and understand HPV vaccination uptake can be applied to other health problems. Being that this theoretical framework is able to successfully factor in various factors influencing the adoption of an innovation such as the HPV vaccine, it has the potential to an apt model to examine influenza vaccination uptake or possibly the acquisition of a future HIV vaccine. Further, an improved understanding of the interplay among factors that influence the decision to adopt or reject the HPV vaccine can be taken into account when developing strategies for increasing vaccination uptake for other types of vaccines, particular series vaccines.

Additionally, this research provides a strong methodological foundation for future vaccination uptake research that uses the DOI innovation decision-process model. The operationalization of measures and analysis methods used in this study can guide future studies that use DOI to examine HPV vaccination uptake. Also, such methods could prove to

be useful for investigating new and unexplored areas of research using the DOI theory. Further, this research could spur other possible applications of DOI and inspire other behavioral science research to utilize DOI in research or intervention design for the promotion of preventative innovations.

Recommendations for Future Research

The results of this research demonstrate that this was a promising preliminary study using DOI to examine HPV vaccination-decision making among African American adolescent females. Due to the encouraging results, which suggest that DOI is an appropriate framework from which to understand HPV knowledge and intent to vaccinate against HPV, future research must be conducted to address the limitations of this study and further explore the explanatory power of DOI as it relates to HPV vaccine-decision-making.

This study was able to establish that DOI is an appropriate framework by operationalizing the DOI constructs using existing measures. However, a notable limitation was that the primary study measures were not developed following the DOI framework. Instead, the items were mapped to the corresponding DOI constructs, limiting the reliability and validity of the study measures. In order to better test the explanatory of the DOI model as it relates to HPV vaccine decision-making, research must be conducted using survey items that are designed to measure the DOI constructs. With this, all constructs and characteristics of the DOI Innovation-Decision Process model should be operationalized prior to data collection. Particularly, all components measuring characteristics of the innovation such as relative advantage, complexity and compatibility should be measured, as this was a limitation in testing the explanatory power of the model for preventative innovations in this study. With

reliable and valid measures that operationalize the DOI model, the explanatory power of the DOI model and the model for preventative innovations can be better understood.

In addition to improving measurement, future research should be conducted that tests the application of DOI to explain and predict HPV vaccine uptake. Rather than use intention to vaccinate as the outcome variable, as this study did, research should examine factors associated with HPV vaccine uptake following the DOI model. Specifically, the process model analyses should be conducted with vaccine series initiation and vaccine series completion as the dependent variables. Rogers' model is designed to understand and explain adoption or rejection of the innovation, rather than intent to adopt or reject an innovation. As a result, the suitability of this model can be further confirmed upon analyzing factors associated with HPV vaccine adoption and rejection.

Due to the fact that this study found that HPV vaccine decision-making can be analyzed following DOI, it is necessary that future research studies test the generalizability of this model. Research must be conducted using a larger sample size in order to obtain more accurate results. Research should be conducted in which the study measures are created following the DOI Innovation-Decision Process model constructs. Specifically, it is important that all components of Characteristics of the Innovation are measured included relative advantage, complexity and compatibility. Future studies should examine HPV vaccine uptake as the dependent variable rather than intent to vaccinate against HPV being that DOI was used created to conceptualize adoption of innovation not intent to adopt an innovation. Additionally, this research should be expanded to include future research must be conducted with other populations such as Hispanics, and now adolescent males, to examine predictors of HPV vaccination as well as test the DOI model.

Additionally, future research and health promotion approaches should test and apply the findings of this study to improve HPV vaccine uptake among African American adolescent females. The results of this research demonstrate that future HPV vaccination strategies should focus on improving and increasing HPV and cervical cancer knowledge, improving perceptions of the HPV vaccine, fostering social support and positive normative beliefs surrounding vaccination, and stressing the individual's susceptibility to HPV and the severity of HPV and cervical cancer. Further, health providers play an imperative role in HPV vaccination promotion and uptake. With this, the HPV vaccine should not be promoted only to those at most risk but to all adolescents. In effect, future research and health promotion approaches should consider such findings.

The successful application of DOI to HPV vaccine decision-making conducted in this study has critical implications for public health. In testing the explanatory power of DOI as applied to HPV vaccine knowledge and intent to vaccinate against HPV, there is a demonstrated need for future research that builds upon the findings of this study. From this research, it is evident that the DOI Innovation-Decision Process model is a comprehensive theoretical framework that can expand the understanding of factors influencing HPV vaccination and ground the development of successful intervention strategies to increase vaccination coverage among adolescents.

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APPENDICES

Appendix A: *Girls OnGuard* Informed Consent Form

EMORY UNIVERSITY SCHOOL OF PUBLIC HEALTH
ADOLESCENT INFORMED CONSENT FORM

Title: *Girls OnGuard*: HPV Vaccination Uptake among African American Adolescent Females

Principal Investigator: Ralph J. DiClemente, PhD

Sponsor: Merck

Why are we doing this study?
You are being asked to be part of a research project. The purpose of the research is to find out if a short DVD will help teen girls decide to receive the Gardasil HPV vaccine. We will enroll 400 African American females who are clients at reproductive health clinics within the Atlanta metropolitan area.

What happens in this study if I join?
You will be asked to complete a 15 minute survey using a laptop computer. The survey will ask questions about your health beliefs, knowledge, attitudes, and sexual behavior. Your responses will be kept private. The project staff will be there to help you. You will be placed by chance (like flipping a coin) in one of two groups. The first group will watch a short DVD about HPV, cervical cancer, and the HPV vaccine. The second group will watch a short DVD about healthy lifestyles choices. We will review your medical records 7 months after you watch the DVD and record your HPV vaccination dates, should you choose to get vaccinated. We will also record information about your STD history while you were in our study.

What about confidentiality?
We will keep all information about you private. At times, people other than those doing the research may look at the records of this study. Groups who make rules about how research is done and those who pay for the research have the right to review records of participants. Groups that have the right to look at records from this research include the Institutional Review Board at Emory University and the study sponsor, Merck. Records can also be released by court order. If this happens, we will keep your records private as much as we can by law. The records will only have a special number for you and not your name when it can. We will keep all research files locked in our office at Emory. Our computer files will be password protected. We may present results of this study in a medical journal or meeting. If we do, we will write it in a way that you cannot be recognized.

Are there risks or benefits to taking part in this study?
We do not think there are any serious risks to being in this study. The risks in this project are due to taking a survey about personal behaviors. You may feel embarrassed when answering some questions. You can refuse to answer any questions. If you become upset during the interview or DVD, we have someone who will talk with you. There may be no direct benefit to you from being in this project, however you may gain information that can help you lead a healthy life.

Alternatives: You do not have to be in the study. If you say no to the study, this will not affect your treatment or future clinic services.

Will there be any costs?
There will be no costs to you for being in this project. For completing the computer interview and watching the DVD, we will give you $10 in cash.

We will give you emergency care if you are injured by this research. However, you will not be given reimbursement for medical care other than what your insurance may provide. You will not receive other compensation. Emory University has not set aside funds to pay for this care or compensate you if a mishap occurs. If you believe you have been injured by this research, you should contact Dr. Ralph DiClemente, the investigator in charge, at 404-727-0237.

What are my rights, and may I withdraw from the study?
Participation in this study is voluntary. You are free to stop being in the study at any time.

Who can I contact if I have any questions or problems?
If you have any questions concerning this study, contact Dr. Ralph DiClemente at 404-727-0237. If you have questions or concerns about your rights as a participant in this research study, you may contact the Emory University Institutional Review Board at 404-712-0720; irb@emory.edu, or toll-free at 877-503-9797.

SIGNATURE FOR DOCUMENTATION OF CONSENT:
The researchers will ask you to sign and date this form. If you are willing to volunteer for this research study, please sign below. We will give you a copy of this consent/authorization form to keep. It should be kept with your personal belongings. Before you sign this form, please ask any questions on anything that is not clear to you. You may take as much time as you need to think this over.

_____
Name of Participant (Print)

_____
Participant's Signature (if 17 or 18 years of age) **Date** **Time**

_____
Person Obtaining Consent **Date** **Time**

ASSENT FROM PEDIATRIC SUBJECTS

Subject age:_____ years

1._____WRITTEN ASSENT (ages 13-16)

WRITTEN ASSENT DOCUMENT

We are asking you to volunteer to be in a research project that will ask you questions on a computer for about 15 minutes. Then you will watch a short DVD about HPV, cervical cancer, and the HPV vaccine OR about healthy lifestyles choices.

The purpose of the research is to find out if a short DVD will help teen girls decide to receive the Gardasil HPV vaccine. The computer interview will not have your name on it. Your answers will be private. We will give you $10 cash when you finish the computer interview and watch the DVD today. We will get your HPV vaccination dates from the medical staff at your clinic, if you choose to get vaccinated, and collect information about your STD history.

You can say no to this study. The research staff or clinic staff cannot make you be in the study if you don't want to participate. If you agree to be in the study but change your mind later, you can stop participating in the study. If you don't want to do the research study, it will not change your treatment or clinic services.

If you agree to be in the study, sign here:

_____
Name of Participant

_____ _____ _____
Signature of Participant **Date** **Time**

_____ _____ _____
Person Soliciting Assent **Date** **Time**

Appendix B: *Girls OnGuard* HIPPA Authorization

Emory University School of Public Health Subject HIPAA Authorization to Use or Disclose Health Information that Identifies You for a Research Study

Name of Study: *Girls OnGuard*, HPV Vaccination Uptake among African American Adolescent Females

Study Number: IRB00015576

Name of Principal Investigator: Ralph J. DiClemente, PhD

Subject Name:_____

The privacy of your health information is important to us. In protecting your health information that identifies you, we will follow all requirements of the Health Insurance Portability and Accountability Act ("HIPAA" for short) that apply. This form will let you know how we will use any health information that you give us for this study that identifies you. Please read this form carefully and if you agree with it, sign it at the end.

Research Study: You are being asked to be part of a research project. The purpose of the research is to find out if a short DVD will help teen girls decide to receive the Gardasil HPV vaccine. We will enroll 400 African American females who are clients at reproductive health clinics within the Atlanta metro area. There may be no direct benefit to you from being in this project, however you may gain information that can help you lead a healthy lifestyle.

People That Will Use or Disclose Your Health Information that Identifies You and Purpose of Use/Disclosure:

The following people and groups will use and disclose your health information in connection with the study. In this form, all of these people and groups are called the "Information Users":

> **The principal investigator, his/her research staff and people and organizations that he uses to help him conduct the Research Study will use and disclose your health information to do this work.**
>
> **Merck, Inc. is/are the sponsor(s) of this Research. The sponsor(s) and all other people and organizations that the sponsor(s) retain(s) to help it conduct and oversee the Research Study may use and disclose your health information to make sure that the research is being done correctly and to collect and analyze the results of the research.**
>
> **There are a number of University persons/units, government agencies and other individuals and organizations that may use and disclose your health information to make sure that the Research Study is being conducted correctly and safely, and to monitor and regulate the research or public health issues. These people and organizations include the following: the Emory University Institutional Review Board; the Emory University Office for Clinical Research; the Emory University Office of**

Research Compliance; research monitors and reviewers; data safety monitoring boards; DeKalb County Board of Health, Fulton County Department of Health and Wellness, and any government agencies who regulate the research including the Office of Human Subjects Research Protections.

By signing this document you agree to allow any of these Information Users to use or disclose your health information that identifies you in order to conduct the Research Study, or to monitor or regulate research. In addition, we will comply with any laws that require us to disclose your health information, such as laws that require us to report child abuse or elder abuse. We also will comply with legal requests, or orders that require us to disclose your health information, such as subpoenas or court orders. Finally, we may share your health information with a public health authority that the law authorizes to collect or receive such information for the purpose of preventing or controlling disease, injury or disability and/or conducting public health surveillance, investigations or interventions.

Description of Health Information that Identifies You that Will be Used or Disclosed: Researchers will look at information that identifies you such as your name, birth date, STI and vaccination history, and answers to the interview questions. They may keep this identifiable information in your research file. Your research file will be labeled by ID only and kept separate from your identifying information.

Revoking your Authorization: You do not have to sign this Authorization. In addition, if you sign this Authorization, later, you may change your mind at any time and revoke (take back) this Authorization. If you want to revoke this Authorization you must write to: Dr. Ralph DiClemente, the investigator in charge. We will give you a pre-printed revocation letter to use.

If you revoke your Authorization, the Researchers will not collect any more health information that identifies you, but they may use or disclose identifiable information that you already gave them in order to notify any of the other Information Users that you have taken back your authorization; to maintain the integrity or reliability of the Research Study; and to comply with any law that they are required to obey.

Other Items You Should Know: HIPAA only applies to people or organizations that are health care providers, health care payers or healthcare clearinghouses. HIPAA may not apply to all Information Users. If HIPAA doesn't apply to an Information User, then that User doesn't have to follow HIPAA requirements when it uses or discloses your health information.

You do not have to sign this authorization form, but if you do not, you may not participate in the Research Study or receive research-related treatment. You may still receive non-research related treatment.

If the Research Study involves medical treatment, then, in order to maintain the integrity of the research study, you generally will not have access to your personal health information related to this Research Study until the study is complete. When the study is complete, then, at your request, you may generally have access to any of your personal health information related to the research that makes up a part of the medical information and/or other records that your health care providers use to make decisions about you. If access to this information is needed before the end of the Research Study for your treatment, then the information may be provided to your physician.

If your identifying information is removed from your health information, then the information that remains will not be subject to this authorization or covered by HIPAA, and it may be used or disclosed to other persons or organizations, and/or for other purposes.

Expiration Date: The Researchers will add your PHI to a database that they are compiling for research purposes. There is no date or event after which your Authorization will expire and your PHI will no longer be used for this purpose.

As a study participant, if you any questions regarding the study, you may call Dr. Ralph DiClemente the study's Principal Investigator at (404) 727-0237. If you have any questions regarding your rights as a study subject, you may call the Emory University Institutional Review Board at 404-712-0720, irb@emory.edu, or 1-877-503-9797.

A copy of this authorization form will be given to you.

_____
Signature of Study Subject OR Subject's Legal Authorized Representative

Date _____ Time_____

_____
Printed Name of Study Subject OR Subject's Legally Authorized Representative

If Representative, Relationship to Study Subject: _____

_____
Signature of Person Obtaining Authorization

Date _____ Time_____

Appendix C: *Girls OnGuard* IRB Approval

EMORY UNIVERSITY

Institutional Review Board

FROM: Aryeh Stein, PhD
Co-Chair

TO: Ralph DiClemente, PhD
Principal Investigator

CC:

Murray	Colleen	Behavioral Science
Sales	Jessica	Behavioral Science
Wingood	Gina	Behavioral Science

DATE: December 10, 2008

RE: **Notification of Expedited Approval**
IRB00015576
Girls OnGuard: HPV Vaccination Uptake among African American Adolescent Females

This is your notification that your above referenced study was reviewed and APPROVED under the Expedited review process per 45 CFR 46.110 (7) Title 45 CFR subpart D 46.404 & 46.408 and 21 CFR 56.110. The approval is valid from **12/10/2008 until 12/9/2009.** Thereafter, continued approval is contingent upon the submission of a continuing review request that must be reviewed and approved by the IRB prior to the expiration date of this study.

Any reportable events (serious adverse events, breaches of confidentiality, protocol deviation or protocol violations) or issues resulting from this study should be reported immediately to the IRB and to the sponsoring agency (if any). Any amendments (changes to any portion of this research study including but not limited to protocol or informed consent changes) must have IRB approval before being implemented.

All correspondence and inquiries concerning this research study must include the IRB ID, the name of the Principal Investigator and the Study Title.

Sincerely,

Aryeh Stein, PhD
Co-Chair
This letter has been digitally signed

EMORY UNIVERSITY

Institutional Review Board

TO: Ralph DiClemente, PhD
Principal Investigator
Behavioral Science

DATE: August 22, 2013

RE: **Continuing Review Expedited Approval**
CR5_IRB00015576
IRB00015576
Girls OnGuard: HPV Vaccination Uptake among African American Adolescent Females

Thank you for submitting a renewal application for this protocol. The Emory IRB reviewed it by the expedited process on 08/22/2013, per 45 CFR 46.110, the Federal Register expeditable categories F(7) and Subpart D 46.404. This re-approval is effective from **09/10/2013** through **09/09/2014**. Thereafter, continuation of human subjects research activities requires the submission of another renewal application, which must be reviewed and approved by the IRB prior to the expiration date noted above.

Any reportable events (e.g., unanticipated problems involving risk to subjects or others, noncompliance, breaches of confidentiality, HIPAA violations, protocol deviations) must be reported to the IRB according to our Policies & Procedures at www.irb.emory.edu, immediately, promptly, or periodically. Be sure to check the reporting guidance and contact us if you have questions. Terms and conditions of sponsors, if any, also apply to reporting.

Before implementing any change to this protocol (including but not limited to sample size, informed consent, and study design), you must submit an amendment request and secure IRB approval.

In future correspondence about this matter, please refer to the IRB file ID, name of the Principal Investigator, and study title. Thank you.

Sincerely,

Carol Corkran, MPH, CIP
Interim Team Lead
This letter has been digitally signed

CC: Murray Colleen Behavioral Science
Wingood Gina Behavioral Science

Appendix D: Codebook of Measures

Girls OnGuard Survey Codebook:

Application of Diffusion of Innovation Theory (DOI) Innovation-Decision Process model constructs to *Girls OnGuard* measures

DOI Innovation-Decision Process model Construct Key:

PC: *Prior conditions of the decision-making unit*

CD: *Characteristics of the decision-making unit*

K: *HPV and cervical cancer knowledge*

CI: *Perceived characteristics of the Innovation*

IV: *Intention to vaccinate*

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
	id	Participant's id number						
	group	Group	I	Intervention				
			C	Control				
	clinic	Clinic name	1	Planned Parenthood				
			2	DeKalb County				
			3	Clayton County				
			4	Carrollton County				
			5	Fulton County				
Demographics								
CD	age	Age in years				Afiya baseline		
CD	edu	What is the last grade that you completed in school? (Choose one)	1	Less than 8th grade		Afiya baseline		
			2	8th grade				
			3	9th grade				
			4	10th grade				
			5	11th grade				
			6	12th grade				
			7	Graduated high school or Received GED				
			8	Refuse to Answer				
CD	liva	Who do you live with? (Choose one)	1	Alone		Afiya baseline		Moderating Factor
			2	Mother and father				
			3	Mother				
			4	Father				
			5	Boyfriend				
			6	Another relative				
			7	Other, please specify				
			8	Refuse to Answer				
CD	livb	Please specify who you live with						
CD	aid	In the past 12 months, did you or anyone you	65	Welfare (including TANF, Temporary	(Need to use individual aid variables on pg 18	Afiya baseline		Moderating Factor

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
		live with receive any money or services from any of the following? (check all items that apply or check NO)		Assistance to Needy Families, or SSI)	for true frequencies of response choices)			
			66	Food stamps				
			67	WIC (Women, Infants, and Children)				
			68	Section 8 housing				
			69	No				
			8	Refuse to Answer				
CD	job	Do you have a job for which you are paid?	0	No		Afiya baseline		Moderating Factor
			1	Yes				
			8	Refuse to Answer				
CD	ins	How would you describe your current health insurance coverage? (Choose one)	1	Private insurance or health plan (For example: Aetna, Blue Cross/Blue Shield)		New/original		Moderating Factor
			2	Medicaid				
			3	GA Child Health Insurance Program (GA CHIP)				
			4	I currently do not have health insurance				
			5	Don't Know				
			8	Refuse to Answer				
	Family history of cancer							
PC	cane	Has anyone in your family ever been told by a doctor that they have cancer?	0	No		New/original		Moderating Factor
			1	Yes				
			7	Don't know				
			8	Refuse to Answer				
PC	cant	How many people total in your family have ever been told by a doctor that they have cancer?	98	Refuse to Answer				
PC	canw	Have any of the women	0	No		New/original		Moderating

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
		in your family ever been told by a doctor that they have cervical cancer?	1	Yes				Factor
			7	Don't know				
			8	Refuse to Answer				
PC	canr1	If yes, how is this person related to you? Please check all that apply.	65	Mother	(Need to use other canr1 variables on pg 19 to get true frequencies)			
			66	Sister				
			67	Grandmother				
			68	Cousin				
			69	Aunt				
			70	Other, please specify				
			8	Refuse to Answer				
PC	canr2	Please specify how this person is related to you.						
PC	canwt	How many women total in your family have ever been told by a doctor that they have cervical cancer?	98	Refuse to Answer				
	Gynecological/medical history							
PC	pap	Have you ever had a Pap smear (a special test where a doctor takes a swab of your cervical cells to check for cancer and other abnormal cells)?	0	No		Afiya baseline		Behavioral Skill
			1	Yes				
			8	Refuse to Answer				
PC	papd	What was the month and year of your most recent Pap smear? Please give your best estimate.			(use papdy, papdm variables on pg 20 for actual values for month/year)			
PC	papp	Did you have a pap smear before your most recent one?	0	No				
			1	Yes				
			8	Refuse to Answer				
PC	pappd	What was the month and			(use pappdy, pappdm			

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
		year of that Pap smear? Please give your best estimate.			variables on pg 20 for actual values for month/year)			
PC	papab	Has a doctor or nurse ever told you that you had an abnormal Pap smear result?	0	No		Kahn et al, 2003; Gerend et al, 2007 (modified)		Motivation
			1	Yes				
			8	Refuse to Answer				
PC	hpv	Have you ever been told by a doctor that you have HPV or the Human Papillomavirus?	0	No		Kahn et al, 2003; Gerend et al, 2007 (modified)		
			1	Yes				
			8	Refuse to Answer				
	Sex history (including pregnancy)							
PC	vs1	Have you ever had vaginal sex (vaginal sex is when a guy puts his penis in your vagina)?	0	No		New/original		Motivation
			1	Yes				
			8	Refuse to Answer				
PC	vs2	How old were you the first time you willingly had vaginal sex? Vaginal sex is when a guy puts his penis in your vagina.	98	Refuse to Answer		Afiya baseline		Motivating/ Moderating factor
CD	vs3	Who do you usually have sex with?	0	Men				
			1	Women				
			2	Both men and women				
			8	Refuse to Answer				
CD	vs4	In general how old are the people you have sex with, are they . . . ? (Choose one)	0	Much younger than you (4 or more years)				
			1	Younger than you (2-3 years)				
			2	About the same age				
			3	Older than you (2-3 years)				
			4	Much older than you (4 or more years)				

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
			8	Refuse to Answer				
PC	vs5	In your entire life, how many guys have you had vaginal sex with?	98	Refuse to Answer				
PC	vs6	In the past 90 days, how many guys have you had vaginal sex with?	998	Refuse to Answer				
PC	preg	Have you ever been pregnant?	0	No				
			1	Yes				
			8	Refuse to Answer				
PC	vs7	The very last time you had vaginal sex, did you use a condom to prevent STIs or pregnancy?	0	No		New/original		Behavioral skill/ Motivation
			1	Yes				
			8	Refuse to Answer				
PC	vs8	The very last time you had vaginal sex, what other type(s) of protection did you use? (Check all that apply)	65	Pill/Patch/Depo/Ring	(Need to use other vs8 variables on pg 20 to get true frequencies)	Afiya baseline		Behavioral skill/ Motivation
			66	Withdrawal				
			67	None				
			68	Other, please specify				
			8	Refuse to Answer				
PC	vs9	Please type in what protection you used						
PC	vs10	In the past 90 days how many times have you had vaginal sex?	998	Refuse to Answer				
PC	vs11	Out of the _____ times you've had vaginal sex in the past 90 days, how many times did you use a condom?	98	Refuse to Answer				

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
PC	vs12	In the past 90 days, how many times did you have vaginal sex while high on alcohol or drugs (including marijuana, ecstasy, GHB, ice, crystal meth, crank, or those needing a medical prescription)?	998	Refuse to Answer		Afiya baseline		Moderating Factor
	Anal sex							
PC	as1	Have you ever had anal sex	0	No		Afiya baseline		Motivation
			1	Yes				
			8	Refuse to Answer				
PC	as2	How old were you the first time you willingly had anal sex?	98	Refuse to Answer		Afiya baseline		Moderating Factor/ Motivation
PC	as3	In the past 90 days, how many times have you had anal sex?	998	Refuse to Answer		Afiya baseline		Moderating Factor/ Motivation
PC	as4	Out of the _____ times you've had anal sex in the past 90 days, how many times did you use a condom?	998	Refuse to Answer		Afiya baseline		Behavioral skill/ Motivation
	Oral sex							
PC	os1	Have you ever performed oral sex?	0	No		Afiya baseline		Motivation
			1	Yes				
			8	Refuse to Answer				
PC	os2	How old were you the first time you willingly performed oral sex?	98	Refuse to Answer		Afiya baseline		Moderating Factor/ Motivation
PC	os3	In your entire life, how many guys have you performed oral sex on?	998	Refuse to Answer		Afiya baseline		Moderating Factor/ Motivation

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
PC	os4	In the past 90 days, how many times have you performed oral sex?	998	Refuse to Answer		Afiya baseline		Behavior/ Motivation
PC	os5	Out of the _____ times you've performed oral sex in the past 90 days, how many times did you use a condom or a dental dam?	998	Refuse to Answer		Afiya baseline		Behavioral skill/ Motivation
	STI history							
PC	stie	Have you ever been told by a doctor that you had a sexually transmitted infection (STI, such as gonorrhea, Chlamydia, herpes, trich, etc.)?	0	No		Afiya baseline		Motivation
			1	Yes				
			8	Refuse to Answer				
PC	stit	How many times have you ever been told by a doctor that you have an STI? (Choose one)	0	Once		Afiya baseline		Motivation
			1	Twice				
			2	Three times				
			3	Four or more times				
			4	None				
			8	Refuse to Answer				
	Relationship history							
CD	rel1	Are you currently in a romantic relationship with…?	0	I am not in a romantic relationship right now		Afiya baseline (modified)		Motivation
			1	A man or boy				
			2	Other				
			8	Refuse to Answer				
CD	rel1s	If other, please specify who you are currently in a romantic relationship with.				New/original		
CD	rel2	How many months have	98	Refuse to Answer		Afiya baseline		Moderation

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
		you been in this relationship?				(modified)		Factor
CD	rel3	How soon after you started dating did you begin having sex? (Choose one)	0	We haven't had sex		Afiya baseline (modified)		Moderating Factor
			1	Within a month				
			2	Less than a month				
			3	More than a month				
			8	Refuse to Answer				
CD	rel4	During this relationship has your partner had sex with another person? (Choose one)	1	Yes		Afiya baseline (modified)		Motivation
			0	No				
			8	Refuse to Answer				
	Casual sex							
CD	csex1	Do you currently have a casual sex partner? A casual sex partner is someone other than a main partner that you occasionally have sex with. This is not a committed relationship.	0	No		Afiya baseline (modified)		Motivation
			1	Yes				
			8	Refuse to Answer				
CD	csex2	The last time you had sex with your casual sex partner was a condom used?	0	No		Afiya baseline (modified)		Motivation
			1	Yes				
			8	Refuse to Answer				
CD	csex3	Since you started having sex with your casual sex partner, have they had vaginal sex with another person?	0	No		Afiya baseline (modified)		Motivation
			1	Yes				
			8	Refuse to Answer				
	HPV/Cervical cancer knowledge							
K	kno1	A person may be	0	True	(For sum score (#	Kahn et al.,	Not Listed	Information

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
		infected with HPV and not know it. (Choose one)	1	False	correct) for this scale, see sumkno variable on pg 21)	2003		
			2	Don't Know				
			8	Refuse to Answer				
K	kno2	Those with HPV may need Pap smears more often. (Choose one)	0	True		Kahn et al., 2003		Information
			1	False				
			2	Don't Know				
			8	Refuse to Answer				
K	kno3	HPV is spread by sexual intercourse. (Choose one)	0	True		Kahn et al., 2003		Information
			1	False				
			2	Don't Know				
			8	Refuse to Answer				
K	kno4	Pap smears detect HPV. (Choose one)	0	True		Kahn et al., 2003		Information
			1	False				
			2	Don't Know				
			8	Refuse to Answer				
K	kno5	HPV can be cured with antibiotics. (Choose one)	0	True		Kahn et al., 2003		Information
			1	False				
			2	Don't Know				
			8	Refuse to Answer				
K	know6	HPV causes abnormal menses (or periods). (Choose one)	0	True		Kahn et al., 2003		Information
			1	False				
			2	Don't Know				
			8	Refuse to Answer				
K	kno7	Smoking increases the chance of getting cervical cancer. (Choose one)	0	True		Kahn et al., 2003		Information
			1	False				
			2	Don't Know				
			8	Refuse to Answer				
K	kno8	Condoms do not always help protect you from HPV. (Choose one)	0	True		Kahn et al., 2003		Information
			1	False				
			2	Don't Know				
			8	Refuse to Answer				
K	kno9	HPV goes away with the right treatment. (Choose	0	True		Kahn et al., 2003		Information
			1	False				

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
		one)	2	Don't Know				
			8	Refuse to Answer				
K	kno10	Certain types of HPV cause cancer. (Choose one)	0	True		Kahn et al., 2003		Information
			1	False				
			2	Don't Know				
			8	Refuse to Answer				
K	kno11	HPV can cause problems with pregnancy. (Choose one)	0	True		Kahn et al., 2003		Information
			1	False				
			2	Don't Know				
			8	Refuse to Answer				
	Perceived susceptibility of HPV							
CI	ps1	My chances of getting HPV in the future are low. (Choose one)	0	Strongly Disagree	(For sum score for susceptibility/severity, see sumps on pg. 21; higher score=greater perceived susceptibility/severity of infection/cervical cancer.	Marlow et al., 2009a (modified)		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	ps2	I worry about getting HPV. (Choose one)	0	Strongly Disagree		Ingledue et al., 2004		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	ps3	I believe I am at risk for getting HPV. (Choose one)	0	Strongly Disagree		Marlow et al., 2009a (modified)		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	ps4	It is possible that I may get HPV in the future. (Choose one)	0	Strongly Disagree		Marlow et al, 2009a		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
			8	Refuse to Answer				
CI	ps5	I have the ability to avoid HPV infection. (Choose one)	0	Strongly Disagree		Ingledue et al, 2004		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
	Perceived susceptibility of cervical cancer							
CI	ps6	I worry about getting cervical cancer. (Choose one)	0	Strongly Disagree		Ingledue et al, 2004		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	ps7	I believe that I am at risk for developing cervical cancer. (Choose one)	0	Strongly Disagree		Ingledue et al, 2004		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	ps8	All women have an equal chance of developing cervical cancer; it is beyond my personal control. (Choose control)	0	Strongly Disagree		Ingledue et al, 2004		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	ps9	My chances of getting cervical cancer are high.	0	Strongly Disagree		Ingledue et al, 2004		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	ps10	I have the ability to avoid cervical cancer.	0	Strongly Disagree		Ingledue et al, 2004		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
	Perceived severity of HPV							

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
CI	ps11	Having HPV would be upsetting to me. (Choose one)	0	Strongly Disagree		Gerend et al., 2007		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	ps12	Having HPV would make it difficult for me to get a long-term sexual partner. (Choose one)	0	Strongly Disagree		Marlow et al., 2009a		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	ps13	I believe that HPV can have serious negative health consequences. (Choose one)	0	Strongly Disagree		Marlow et al., 2009a		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	ps14	I believe that HPV can be extremely harmful. (Choose one)	0	Strongly Disagree		Marlow et al., 2009a		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	ps15	I believe that HPV causes cervical cancer. (Choose one)	0	Strongly Disagree		New/original		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	ps16	HPV is a life-threatening infection. (Choose one)	0	Strongly Disagree		Ingledue et al., 2004		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	ps17	I believe HPV is curable with proper medical treatment. (Choose one)	0	Strongly Disagree		Ingledue et al., 2004		Motivation
			1	Disagree				
			2	Agree				

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
			3	Strongly Agree				
			8	Refuse to Answer				
	Perceived severity of cervical cancer							
CI	ps18	All women who develop cervical cancer must have their uterus removed. (Choose one)	0	Strongly Disagree		Ingledue et al., 2004		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	ps19	Among the diseases that I can imagine, getting cancer of the cervix is among the most serious. (Choose one)	0	Strongly Disagree		Ingledue et al., 2004		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	ps20	No one dies anymore of cervical cancer. (Choose one)	0	Strongly Disagree		Ingledue et al., 2004		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	ps21	Cervical cancer is often curable with early detection and proper medical treatment. (Choose one)	0	Strongly Disagree		Ingledue et al., 2004		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
	Beliefs about vaccination (in general)							
CI	vbg1	Getting any vaccine could be risky. (Choose one)	0	Strongly Disagree	(For sum score for vaccine barriers in general, see sumvbg on pg 21; higher # = more barriers to vaccination in general.	Gerend et al., 2007	Not Listed	Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	vbg2	I don't like having to get shots (injections). (Choose one)	0	Strongly Disagree		Gerend et al., 2007		Motivation
			1	Disagree				
			2	Agree				

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
			3	Strongly Agree				
			8	Refuse to Answer				
CI	vbg3	I cannot get any vaccines if health insurance will not cover the cost of the vaccine. (Choose one)	0	Strongly Disagree		Gerend et al., 2007 (modified)		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	vbg4	I am concerned about possible bad side effects of any vaccine. (Choose one)	0	Strongly Disagree		Marlow et al., 2009a (modified)		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	vbg5	Vaccines are the most effective way to prevent disease. (Choose one)	0	Strongly Disagree		Marlow et al., 2009a (modified)	.57	Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	vbg6	It is very important that I receive all my vaccines. (Choose one)	0	Strongly Disagree		Marlow et al., 2009a	.57	Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	vbg7	It is better to get a disease and get protected from it naturally than to be vaccinated. (Choose one)	0	Strongly Disagree		Marlow et al., 2009a	.57	Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
	Beliefs about HPV vaccination (specific)							
CI	vbh1	I would be very worried about the side effects of the HPV vaccine. (Choose one)	0	Strongly Disagree	(For sum score of HPV vaccination barriers, see sumvbh on pg. 21; higher # = more barriers	Marlow et al., 2009a (modified)		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
			8	Refuse to Answer	to HPV vaccination.)			
CI	vbh2	If I got the HPV vaccine, I would be more likely to have unprotected sex. (Choose one)	0	Strongly Disagree		Marlow et al., 2009b (modified)	.69	Behavior
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	vbh3	Getting the HPV vaccination would be a good way to protect myself against cervical cancer. (Choose one)	0	Strongly Disagree		Marlow et al., 2009a (modified)	.81	Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
CI	vbh4	Getting the HPV vaccination would be a good way to protect myself from HPV. (Choose one)	0	Strongly Disagree		Marlow et al., 2009a (modified)	.81	Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
	HPV vaccination acceptability (likelihood of vaccination)							
-	hpv_info	How likely is it that you will try to get more information about the HPV vaccine? (Choose one)	0	Very unlikely		Gerend et al., 2007 (modified)	.90	Behavior
			1	Somewhat unlikely				
			2	A little unlikely				
			3	A little likely				
			4	Somewhat likely				
			5	Very likely				
			8	Refuse to Answer				
IV	hpv_today	How likely is it that you will actually get the HPV vaccine <u>today</u>? (Choose one)	0	Very unlikely		Gerend et al., 2007 (modified)	.90	Behavior
			1	Somewhat unlikely				
			2	A little unlikely				
			3	A little likely				
			4	Somewhat likely				
			5	Very likely				
			8	Refuse to Answer				
IV	hpv_future	How likely is it that you will get the HPV vaccine	0	Very unlikely		Gerend et al., 2007	.90	Behavior
			1	Somewhat unlikely				

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
		if a healthcare provider offers it to you in the next 12 months? (Choose one)	2	A little unlikely		(modified)		
			3	A little likely				
			4	Somewhat likely				
			5	Very likely				
			8	Refuse to Answer				
	Normative beliefs							
PC	nb1	My doctor will think it is a good idea for me to get the HPV vaccine. (Choose one)	0	Strongly Disagree	(For sum score for normative beliefs, see sumnb on pg 21; higher # = greater social/peer influence to HPV vaccination	Gerend et al., 2007 (modified) Flu study (modified)	Not Listed	Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
PC	nb2	Most people important to me think I should get the HPV vaccine. (Choose one)	0	Strongly Disagree		Flu study (modified)		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
PC	nb3	My best friend(s) think I should get the HPV vaccine. (Choose one)	0	Strongly Disagree		Flu study (modified)		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
PC	nb4	My mother will think it's important for me to get the HPV vaccine. (Choose one)	0	Strongly Disagree		(Flu study modified)		Motivation
			1	Disagree				
			2	Agree				
			3	Strongly Agree				
			8	Refuse to Answer				
		-END-						
	Select all that apply, free responses, and created summary variables							
CD	aida	Welfare (including	0	No				

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
		TANF (Temporary Assistance to Needy Families) or SSI): In the past 12 months, did you or anyone you live with receive any money or services from: Welfare (including TANF or SSI)	1	Yes				
			8	Refuse to Answer				
CD	aidb	Food stamps: In the past 12 months, did you or anyone you live with receive any money or services from: Food Stamps	0	No				
			1	Yes				
			8	Refuse to Answer				
CD	aidc	WIC (Women, Infants, and Children): In the past 12 months, did you or anyone you live with receive any money or services from: WIC	0	No				
			1	Yes				
			8	Refuse to Answer				
CD	aidd	Section 8 housing (housing subsidies): In the past 12 months, did you or anyone you live with receive any money or services from: Section 8 housing	0	No				
			1	Yes				
			8	Refuse to Answer				
CD	aide	In the past 12 months, did you or anyone you live with receive any money or services from any of the following (listed above, aida-d).	0	No				
			1	Yes				
			8	Refuse to Answer				
PC	canr1a	Person in family that has	0	No				

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
		been told by a doctor that they have cervical cancer: Mother	1	Yes				
			8	Refuse to Answer				
PC	canr1b	Person in family that has been told by a doctor that they have cervical cancer: Sister	0	No				
			1	Yes				
			8	Refuse to Answer				
PC	canr1c	Person in family that has been told by a doctor that they have cervical cancer: Grandmother	0	No				
			1	Yes				
			8	Refuse to Answer				
PC	canr1d	Person in family that has been told by a doctor that they have cervical cancer: Cousin	0	No				
			1	Yes				
			8	Refuse to Answer				
PC	canr1e	Person in family that has been told by a doctor that they have cervical cancer: Aunt	0	No				
			1	Yes				
			8	Refuse to Answer				
PC	canr1f	Person in family that has been told by a doctor that they have cervical cancer: Other	0	No				
			1	Yes				
			8	Refuse to Answer				
PC	papdy	Year: What was the year and month of your most recent Pap smear? Please give your best estimate.						
			98	Refuse to Answer				
PC	papdm	Month: What was the year and month of your most recent Pap smear? Please give your best estimate.						
			98	Refuse to Answer				
PC	pappdy	Year: What was the year						

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
		and month of the previous Pap smear? Please give your best estimate.	98	Refuse to Answer				
PC	pappdm	Month: What was the year and month of the previous Pap smear? Please give your best estimate.						
			98	Refuse to Answer				
PC	vs8a	Pill/Patch/Depo/Ring: The very last time you had vaginal sex	0	No				
			1	Yes				
			8	Refuse to Answer				
PC	vs8b	Withdrawal: The very last time you had vaginal sex	0	No				
			1	Yes				
			8	Refuse to Answer				
PC	vs8c	None: The very last time you had vaginal sex	0	No				
			1	Yes				
			8	Refuse to Answer				
PC	vs8d	Other: The very last time you had vaginal sex	0	No				
			1	Yes				
			8	Refuse to Answer				
K	sumkno	Total number correct on knowledge items; higher # = more correct responses	#		Score range: 0-11	Kahn et al., 2003		
CI	sumps	Sum of 21 perceived susceptibility items; higher # = greater perceived susceptibility to HPV/Cervical cancer	#		Score range: 0-63	Combination of Ingledue et al., 2004, Marlow et al., 2009a, Gerend et al., 2007, and new/original item		

ACASI Survey Items								
DOI Construct	**ACASI Variable Name**	**Variable**	**Response Choices**		**Range/Scoring**	**Source**	**Internal Consistency**	**Mapping to IMB Model**
CI	sumvbg	Sum of 7 vaccination (in general) barrier/benefit items; higher # = more barriers to vaccination in general	#		Score range: 0-21	Combination of Gerend et al., 2007, and Marlow et al., 2009a		
CI	sumvbh	Sum of 4 HPV barrier/benefit vaccination specific questions; higher # = more barriers to HPV vaccination	#		Score range: 0-12	Modified from Marlow et al., 2009a, 2009b, and new/original item		
PC	sumnb	Sum of 4 normative belief questions; higher # = greater social/peer influence to HPV vaccination	#		Score range: 0-12			

Appendix E: Additional Figures

Figure 3: Bivariate correlates of HPV and cervical cancer knowledge

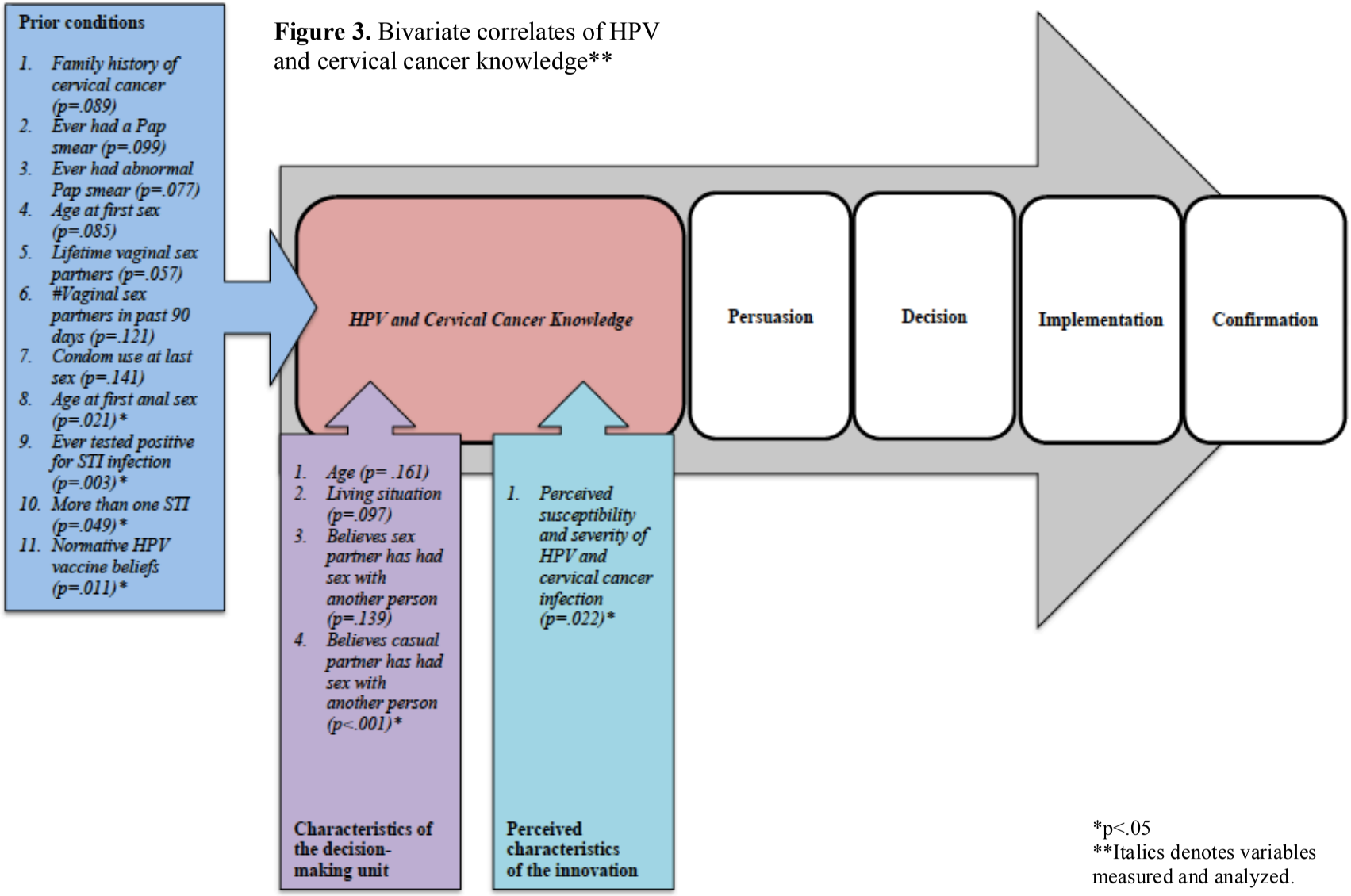
Figure 4: Bivariate correlates of intent to vaccinate today

Figure 5: Bivariate correlates of intent to vaccinate in the next 12 months with a provider recommendation

Figure 6: Regression correlates of intent to vaccinate today

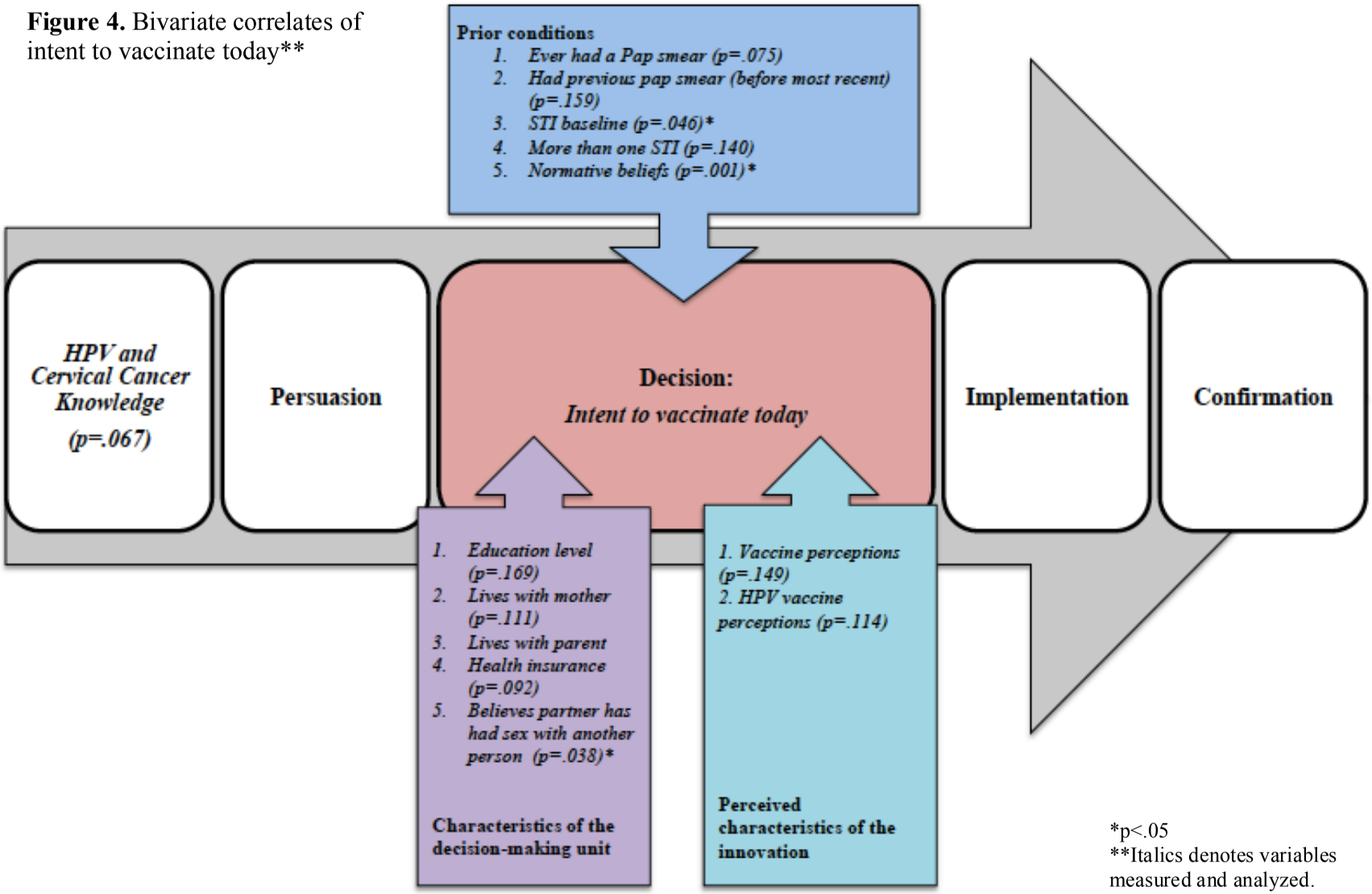
Figure 7: Regression correlates of intent to vaccinate in the next 12 months with a provider recommendation

Figure 3. Bivariate correlates of HPV and cervical cancer knowledge**



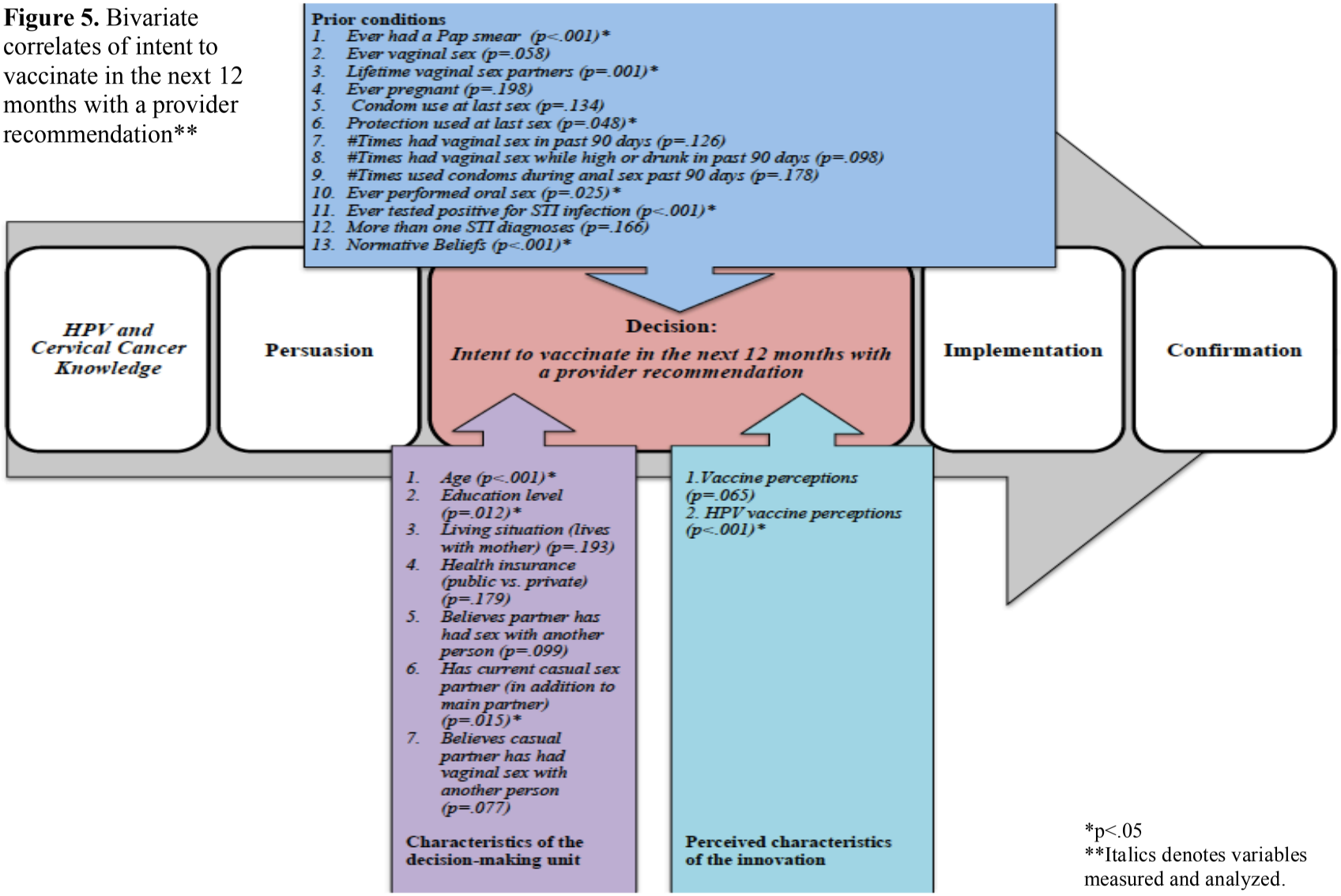
*p<.05
**Italics denotes variables measured and analyzed.

Figure 4. Bivariate correlates of intent to vaccinate today**



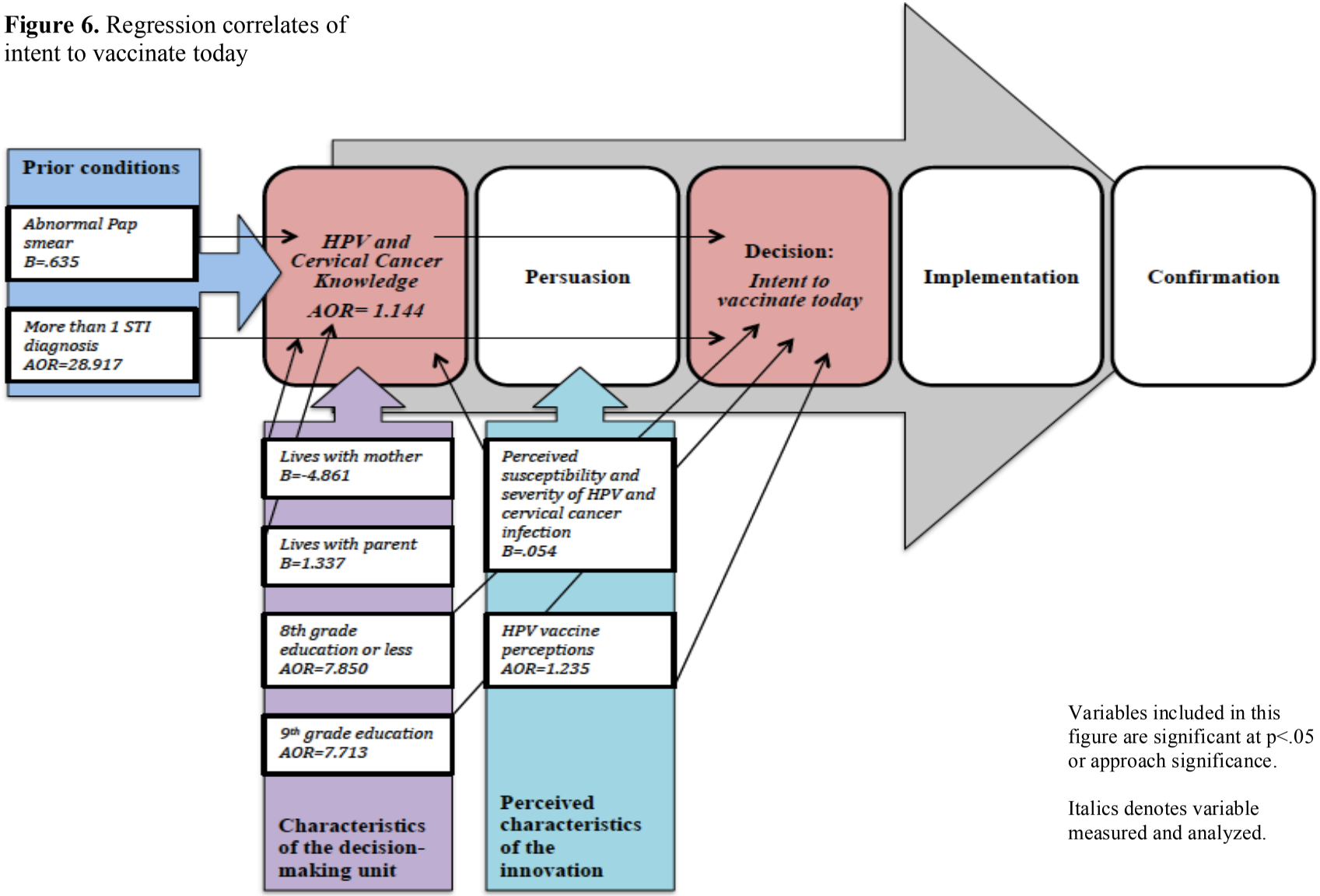
*p<.05
**Italics denotes variables measured and analyzed.

Figure 5. Bivariate correlates of intent to vaccinate in the next 12 months with a provider recommendation**



*p<.05
**Italics denotes variables measured and analyzed.

Figure 6. Regression correlates of intent to vaccinate today



Variables included in this figure are significant at p<.05 or approach significance.

Italics denotes variable measured and analyzed.

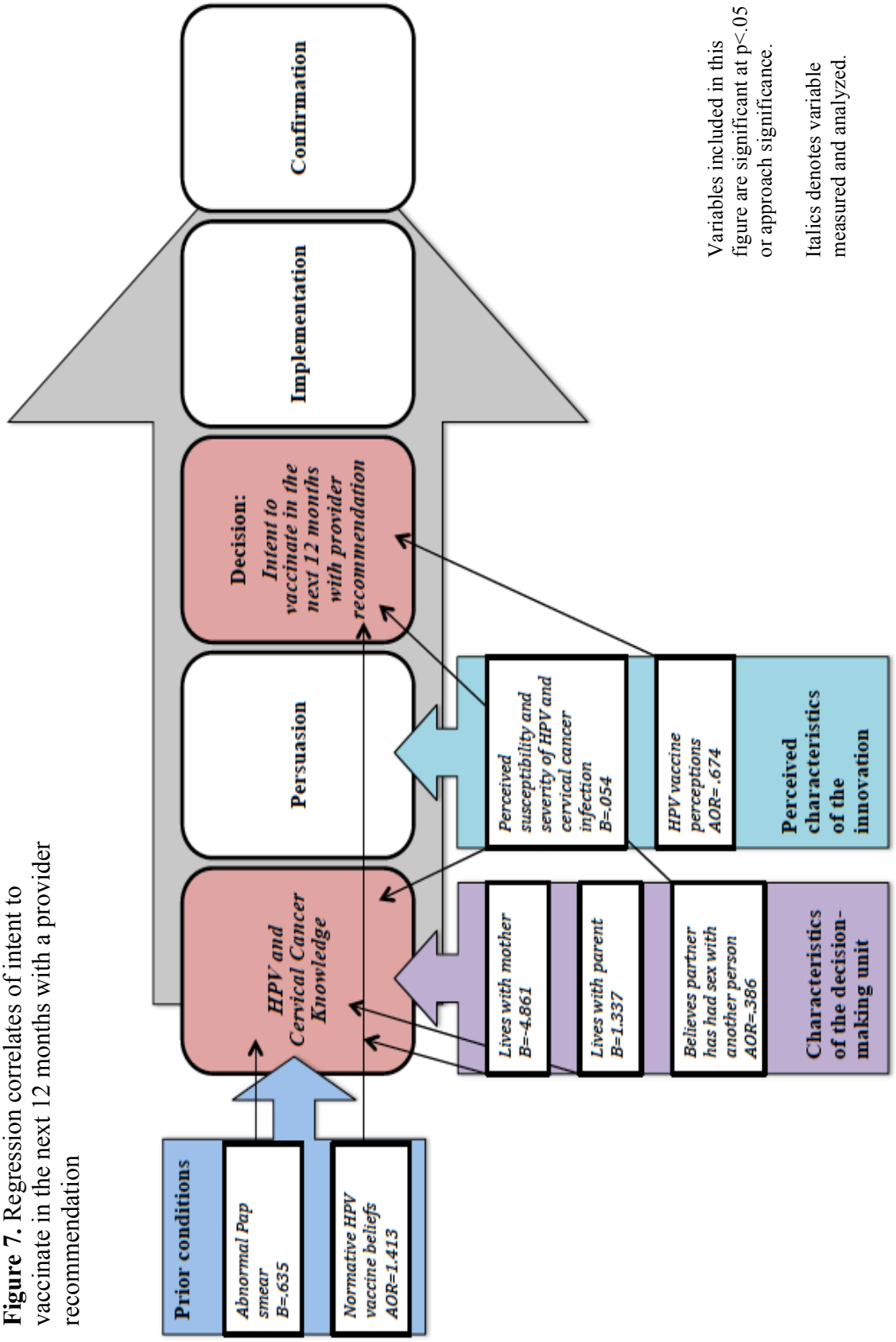


Figure 7. Regression correlates of intent to vaccinate in the next 12 months with a provider recommendation