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CORRELATES OF HPV VACCINATION AMONG A FEMALE
COLLEGE STUDENT SAMPLE

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ABSTRACT

Human papillomavirus (HPV) is the most common sexually transmitted infection, particularly among young adults. In 2006, a vaccine called Gardasil® was introduced to protect against the 4 most virulent strands of HPV, types 6, 11, 16, and 18. Most research on the HPV vaccine has examined acceptability and intentions of getting vaccinated rather than actual vaccine uptake and has focused on adolescents and their parents. The present study attempted to address this lack of research on actual vaccine uptake by assessing correlates of HPV vaccination among a female college student sample ($N=308$). The predictors assessed were demographic variables, including race/ethnicity and mother's education, as well as romantic relationship status, lifetime sex, lifetime number of partners, recent condom use, and health motivations against sex. Two logistic regressions were performed, one including the analytic sample of female college students and one including a subsample of sexually active female college students ($N=190$). Results indicated that African American female college students were less likely to be vaccinated and female college students whose mothers were more educated were more likely to be vaccinated.

Keywords: HPV vaccine, predictors of vaccination, female college students

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Background

Human papillomavirus (HPV) is the most common sexually transmitted infection (STI) in the United States (Basemen & Koutsky, 2005; Gerend & Magloire, 2008; Weinstock, Berman, & Cates, 2004). The Center for Disease Control and Prevention (CDC, 2011) estimates that roughly 20 million Americans are currently infected with HPV and an additional 6 million become newly infected each year. Most people are at risk for acquiring HPV between the ages of 17-26, a period when many young Americans are enrolled in college (Dunne et al., 2007). Consequently, sexually active young adults under the age of 25 have the highest rates of infection (Gerend & Magloire, 2008; Koutsky, 1997). The purpose of the present study was to determine correlates of HPV vaccine uptake among a female college student sample, all of whom were in the age of highest risk for contracting HPV.

HPV is so highly prevalent that about 50% of sexually active adults will have it at some point in their lives, though the majority of cases will resolve on their own because most strands of the infection are asymptomatic (CDC, 2011; Friedman & Sheppard, 2006; Koutsky, 1997). Spread through genital skin to skin contact during sexual activity, HPV is responsible for the development of genital warts (predominantly caused by HPV types 6 and 11) and cervical cancer (predominantly caused by HPV types 16 and 18; Bosch, Lorincz, & Muñoz, 2002; Christian, Christian, & Hopenhayn, 2009; Walboomers et al., 1999). For women, cervical cancer is the second most common cancer worldwide, responsible for roughly 500,000 new diagnoses each year, 260,000 of which are fatal (Parkin, Bray, Ferlay, & Pisani, 2005). Papanicolaou (Pap) testing has been responsible for significantly reducing the occurrence of cervical cancer in the United States and other industrialized nations. Despite these advances, the American Cancer Society (2010) estimates that approximately 12,200 new cases of invasive cervical cancer and

about 4,210 deaths from cervical cancer would have occurred in the United States in the year 2010.

Recent scientific advances have led to the development of a vaccine to prevent the onset of high-risk strains of HPV and consequently halt the development of cervical cancer (Markowitz et al., 2007). The HPV vaccine, called Gardasil®, was approved and released by the U.S. Food and Drug Administration (FDA) in June 2006 and protects against HPV types 16 and 18, which are responsible for 70% of cervical cancer cases, and HPV types 6 and 11, which cause 90% of all genital warts. In March of 2007, The Advisory Committee on Immunization Practices (ACIP) recommended the vaccine for routine use for 11 and 12 year old girls. In addition, the ACIP recommended catch-up vaccinations for females between 13 and 26 who have not been vaccinated (Markowitz et al., 2007). In order to be most effective, the vaccine should be administered prior to the onset of sexual activity so that the individual getting vaccinated is unlikely to already be infected. The HPV vaccine is projected to reduce cervical cancer incidence up to 70%.

Introduction

College Students' Developmental Period

Though the HPV vaccine is recommended to be administered to younger adolescents, it is approved for older adolescents and young adults. It is important to determine HPV vaccination rates and predictors of vaccination among this population because young adults and older adolescents are likely to take a more active role when deciding to get vaccinated considering their increasing independence from adults, such as parents (Arnett, 2000; Jones & Cook, 2008; Zimet, 2005).

Arnett (2000) proposes a new theory of development, referred to as emerging adulthood, which addresses the complexities of young adulthood and the transition to adulthood. Young adults between the ages of 18 to 24 are largely considered to be “transitioning to adulthood” (Schulenberg, Bryant, & O’Malley, 2004). Arnett’s concept involves development from the late teens into the early twenties, with a focus on ages 18 to 25. Emerging adulthood addresses people living in industrialized nations, such as in the United States and Western Europe, because Arnett suggests that emerging adulthood is culturally constructed and not a universal phenomenon. Arnett argues that societal changes in the past half century have made the late teens and early twenties an extended period of transition into adult roles characterized by exploration and change in possible life directions. Hence, Arnett suggests that this time period is developmentally distinct from young adulthood and should be considered separate.

Arnett (2000) proposes that college is the context that best supports the developmental period of emerging adulthood. One reason is that most people attending college are within the age period he deemed typical of emerging adults (18 to 25). It is true that almost half (46%) of people between the ages of 18 and 24 are enrolled in college (U.S. Census Bureau, 2007). Even more impressive is the number of high school graduates who go on to attend college; The Bureau of Labor Statistics (2009) reported in October 2009 that 70% of 2009 high school graduates were enrolled in college.

The freedom associated with attending college (not monitored by parents, living on own, not committed to work) allows for identity exploration as well as exploration in love and work (Arnett, 2000; Roisman, Masten, Coatsworth, & Tellegen, 2004; Schulenberg et al., 2004). There is more time for exploration than in the past because marriage and parenthood are now, for the most part, delayed until the mid- or late-twenties. In addition, there is an increasing amount of

time between first sexual intercourse and age of marriage (Lefkowitz & Gillen, 2006). The average age of first sexual intercourse is 16.9 for males and 17.4 for females (Alan Guttmacher Institute, 2002), whereas the median age of marriage is 28 for males and 26 for females (U.S. Census Bureau, 2009). Hence, there is a significant amount of time between young adults' first sexual intercourse and first marriage to allow for sexual activity before settling into a commitment.

In addition to exploration in identity, love, and work, emerging adults are confronted with decisions as to whether or not to engage in risky behaviors (Arnett, 2000; Schulenberg et al., 2004). Emerging adults exhibit high rates of risk behavior, including substance use and risky sexual behaviors (Arnett, 2000; Brown & Vanable, 2007). It is possible that risk behavior and sensation seeking during this developmental period occur more frequently than in any other period because emerging adults are not monitored as they were in adolescence and are not constrained by roles and responsibilities, such as marriage and parenthood, as they will be in adulthood (Arnett, 1996; Arnett, 2000). For example, Arnett (1996) found that prevalence rates for reckless and risky behavior such as sex without contraception and sex with someone known only casually were substantially higher for college students than for high school students, which provide support for the idea that risky behavior is more likely to occur in emerging adulthood because of the freedom associated with the period.

Rates of Sexual Activity Among College Students

The high prevalence of risky sexual behaviors and STIs for emerging adults may be associated with high rates of sexual activity among college students. Between 70 to 80% of college students report being sexually active (Brunner-Huber & Ersek, 2009; Siegel, Klein, & Roghmann, 1999). Rates of sexual activity vary by year in college; the percentage of students

ever having had vaginal sex tends to rise steadily as college students progress from first to fourth year (Siegel et al., 1999). Rates of sexual activity also tend to vary by gender: for men and women ages 18 to 19 in the United States, reported rates of sexual activity are 74% and 66%, respectively (Mosher, Chandra, & Jones, 2005). Frequency of sexual activity among college students is also relatively common; 46% of college students report engaging in vaginal intercourse in the past 30 days and 40% of college students report having had sex at least once per week (American College Health Association, 2007; Prince & Bernard, 1998). Hence, most college students are sexually active and have sex frequently.

In addition to having regular sex, many college students have had sex with more than one person. Roughly half of all college students report having had 1 to 2 partners, 18% have had 3 to 4 partners, 9.5% have had 5 to 9 partners, and 4.5% have had 10 or more partners in their lifetime (Turchik & Garske, 2009). Men are significantly more likely to have reported multiple sexual partners than women (Prince & Bernard, 1998).

Protective Sexual Behaviors

It is evident that college students have sex and many have multiple partners. This information is important because both are risk factors for contracting HPV (Bosch et al., 2002; Gerend & Magloire, 2008). Among STI literature, there is little research on the frequency of vaccination against HPV among college students. However, research on protective sexual behaviors can suggest predictors for HPV vaccination because getting vaccinated against HPV is a protective sexual behavior. Thus, it is important to turn toward other protective sexual behaviors among college students as a reference, including condom use.

Condoms are the most common contraceptives used among college students with reports indicating that between 50 and 68% of those who are sexually active use condoms (Lewis et al.,

2009; Prince & Bernard 1998; Siegel et al., 1999). Condom use is different from HPV vaccination in that the decision to use condoms happens during the sexual event and requires the active participation of the male partner. On the other hand, the use of condoms is similar in that both condoms and the HPV vaccine protect against the transmission of HPV. Consistent condom use significantly protects women from contracting HPV, especially from the high risk strains of HPV that cause cervical cancer and genital warts; however, condoms do not fully protect an individual from transmission (Winer et al., 2006).

College students report using condoms inconsistently despite high rates of sexual activity and the high prevalence of STIs among this population (Lewis, Miguez-Burbano, & Malow, 2009; Prince & Bernard, 1998). Research has shown that about 35% of sexually active college students always use condoms (Opt & Loffredo, 2004) and only 10% use condoms consistently (Prince & Bernard, 1998). Being in a monogamous relationship and preferring other forms of contraception are two of the most common barriers against using condoms (Fazekas, Senn & Ledgerwood, 2001; Prince & Bernard, 1998). Individuals in monogamous relationships may not use condoms consistently because they believe they are not at risk for contracting STIs and report using other forms of contraception, particularly oral contraceptives (Bolton, McKay, & Schneider, 2010; Wendt & Solomon, 1995).

In addition to differing based on relationship status, the use of condoms and oral contraceptives has been shown to vary by age. There is a significant shift toward oral contraceptive use and away from condom use as age increases (Mosher, 1990). For girls between the ages of 15 to 19, 59% report using oral contraceptives and 33% report using condoms. Among those between the ages of 20 to 24, oral contraceptive users increases to 68% and condom users decreases to 15%. This shift away from condoms and toward oral contraceptives

puts individuals at risk because oral contraceptives do not protect against STIs and sexually active young adults under the age of 25 have the highest rates of STI infection, and more specifically, HPV infection (Gerend & Magloire, 2008; Koutsky, 1997; Scholly, Katz, Gascoigne, & Holck, 2005).

Although research has shown that the majority of college students are sexually active, a considerable number have chosen to remain abstinent. One study found that among college students, 34% are primary abstainers, defined as never having had vaginal intercourse and intentionally practicing abstinence, and 12.5% are secondary abstainers, defined as having had vaginal intercourse but now practicing abstinence (Rasberry & Goodson, 2006). Hence, abstinence is still somewhat common among college students despite the idea that being sexually active is the norm.

Acceptability, Motivations, and Intentions of Getting Vaccinated against HPV

Because the HPV vaccine is targeted at young adolescents, studies regarding the acceptability of the vaccine primarily address parental acceptance (Constantine & Jerman, 2010) or young adolescent acceptance (Christian et al., 2009). These studies have yielded similar results; the majority (in many cases, over 70%) of parents or young adolescents report being receptive to HPV vaccination for themselves or their adolescent daughters (Christian et al., 2009; Constantine & Jerman, 2010; Scarinci, Garces-Palacio, & Partridge, 2007). In general, research has demonstrated little to no race differences in HPV vaccine acceptability; African American, Hispanic American, and European American respondents have been found to be equally accepting of the HPV vaccine (Brewer & Fazekas, 2007).

Little research has examined HPV vaccine acceptability for young adult or older adolescent populations. Young adults and older adolescents are likely to take a more active role

when deciding to get vaccinated considering their increasing independence from parents (Arnett, 2000); therefore, it is important to determine their rates of HPV vaccination (Jones & Cook, 2008; Zimet, 2005).

The first step in accepting the HPV vaccine is awareness of and education about the vaccine, and more importantly, HPV in general (Friedman & Sheppard, 2007; Jones & Cook, 2008; Lloyd, Marlow, Waller, Miles, & Wardle, 2009; Scarinci et al., 2007). Despite the prevalence of HPV, a nation-wide survey conducted in 2000 found that only 2% of Americans were able to name HPV as an STI and less than a third had ever heard of it (Henry J. Kaiser Family Foundation, 2000). In contrast, a more recent study conducted with college students found that awareness of HPV is relatively high, with more than 75% of participants indicating that they had heard of HPV (Gerend & Magloire, 2008). Thus, awareness of HPV may be increasing, which is imperative to vaccination acceptability and intentions. Research has shown that after adolescents receive information about HPV and the vaccine, they have more positive intentions about getting tested, cervical screening, and in particular, becoming vaccinated (Lloyd et al., 2009).

In addition to awareness and knowledge of HPV, having had sex and number of sexual partners are also found to be associated with vaccine acceptability and intentions (Gerend & Magloire, 2008; Jones & Cook, 2008; Lloyd et al., 2009). Ever having an STI, knowing someone with an STI or HPV, ever having had sex, and having multiple sexual partners are associated with college students' greater intentions to become vaccinated (Gerend & Magloire, 2008; Jones & Cook, 2008). In addition, greater perceived risk toward contracting HPV is associated with increased intentions to becoming vaccinated. These results suggest that sexually active college students, particularly those who have had multiple sexual partners, have greater intentions

toward becoming vaccinated against HPV because they perceive themselves to be at a higher risk for contracting the STI.

Unlike those who are sexually active, women between 18 and 26 years old who are not yet sexually active express the least amount of interest in becoming vaccinated (Gerend & Magloire, 2008). For instance, Caskey, Lindau and Alexander (2009) found that 30% of unvaccinated women between 13 and 26 report foregoing the vaccine because they thought they are not at risk because they were not currently sexually active. These findings suggest that those who would gain the most from becoming vaccinated (those who are not yet sexually active) may have less motivation to get vaccinated because they do not feel at risk for becoming infected.

Predictors of HPV Vaccine Uptake

The majority of studies that assess predictors of becoming vaccinated against HPV examine attitudes toward the vaccine, such as acceptability, motivations, and intentions of becoming vaccinated. Little research addresses actual vaccine uptake.

The strongest predictor of becoming vaccinated among women between 13 and 26 years old is medical insurance coverage for the cost of vaccination (Conroy et al., 2009). Younger individuals have higher rates of vaccination because they are more likely to have health insurance. In addition to being insured, suggestion from healthcare providers to receive the vaccine is associated with increased likelihood of becoming vaccinated as well as increased intentions to get vaccinated, particularly among college students (Caskey et al., 2009; Conroy et al., 2009; Daley et al., 2010; Jones & Cook, 2008). Hence, having health insurance and receiving suggestions from healthcare providers are both predictive of HPV vaccine acceptability; however, lack of health insurance is a barrier against becoming vaccinated.

In addition to lack of health insurance and suggestions from healthcare providers, another common barrier to becoming vaccinated against HPV is the stigma that is associated with HPV because it is an STI (Friedman & Sheppard, 2007; Gerend & Magloire, 2008; Scarinci et al., 2007; Waller, Marlow, & Wardle, 2007). Among college students, younger students, male students, and students with less knowledge about HPV and its prevalence associate HPV infection with higher levels of shame (Gerend & Magloire, 2008). Similarly, those who are aware of HPV as an STI associate infection with higher levels of stigma and shame compared to those who are unaware of HPV as an STI (Waller et al., 2007). Those who understand HPV as relatively common report less shame and stigma compared to those who are unaware of its prevalence. Hence, HPV is stigmatized as an STI and associated with higher levels of shame, which could prevent individuals from becoming vaccinated.

Other common barriers to vaccination include cost of the vaccination, lack of knowledge about HPV and the vaccination, and side effects associated with becoming vaccinated (Caskey et al., 2009; Friedman & Sheppard, 2007; Scarinci et al., 2007). The most common barriers reported by female college students are side effects (43%), costs (42%), not knowing enough about the vaccine (36%), and not being sexually active (19%; Burke, Vail-Smith, White, Baker, & Mitchell, 2007). Other reported barriers include fear of needles and having to go to a doctor to get vaccinated. Of those who state they are not sexually active, 67% report not being sexually active as the main reason they would not become vaccinated. Of those who report they would not get vaccinated, 38% are not sexually active. Because those who are not sexually active would benefit the most from the vaccine, it would be better if they were more accepting of getting vaccinated (Gerend & Magloire, 2008).

The Present Study

Research on HPV vaccination primarily addresses attitudes toward HPV vaccination, such as motivations and intentions, rather than actual vaccine uptake. Likewise, to my knowledge, no research examines associations between protective STI behaviors and HPV vaccination uptake. Rather, research on HPV vaccination uptake focuses on rates of insurance and suggestion from doctors. The present study attempted to address this lack of research on actual vaccine uptake by assessing correlates of HPV vaccination among a female college student sample. Based on previous literature, I had the following research questions and hypotheses.

First, because one of the strongest predictors of getting vaccinated against HPV is having health insurance, I wanted to assess mother's education as a predictor to determine if there were demographic differences in HPV vaccine uptake (Conroy et al., 2009). Hence, the first research question was:

1. Do HPV vaccination rates for female college students differ based on socioeconomic status as measured by mother's education?

Second, research reveals little to no race differences in HPV vaccine acceptability, however to my knowledge, there is no research examining race differences in HPV vaccine uptake (Brewer & Fazekas, 2007). In general, there are race differences in vaccination rates for other vaccines, with African Americans less likely to be vaccinated compared to other racial/ethnic groups (Sengupta, Corbie-Smith, Thrasher, & Strauss, 2004). It is important to determine if race differences exist in rates of HPV vaccination in order to determine whom to target for vaccination. Hence, the second research question was:

2. Are there race/ethnicity differences in HPV vaccination rates for female college students?

Third, literature on condom use suggests that individuals who are in monogamous relationships are less likely to use condoms because they perceive themselves at less risk of contracting an STI (Fazekas et al., 2001; Prince & Bernard, 1998). It is possible that those in monogamous relationships may also be less inclined to be vaccinated because they perceive themselves at less risk of contracting HPV; hence, the third hypothesis was:

3. Female college students who have been in a serious romantic relationship will be less likely to be vaccinated.

Though it has been established that a characteristic of young adulthood is engagement in risky behaviors, another task associated with young adulthood is adopting a healthy lifestyle and moving past the risky behaviors associated with adolescence, such as risky sexual behaviors (Schulenberg et al., 2004). Because getting vaccinated is a healthy behavior, it is important to assess the significance of health to female students, particularly health related to sex because HPV is an STI. It is possible that female students who have healthy attitudes toward sex may also endorse healthy behaviors, such as getting vaccinated against HPV. The following is the fifth hypothesis, which was included to determine if health motivations against sex were related to HPV vaccine uptake:

4. Female college students who report higher health motivations against sex will be more likely to be vaccinated.

Previous literature demonstrates that individuals who are sexually active and have had multiple sexual partners are more receptive to HPV vaccination (Burke et al., 2007; Gerend & Magloire, 2008; Jones & Cook, 2008). These findings suggest that individuals who perceive

themselves at a greater risk of contracting HPV (individuals who are sexually active and have multiple partners) have more positive attitudes toward vaccination than individuals who perceive themselves at low risk for contracting HPV. I included these constructs in the present study to determine if sexually active female students and those with more partners would be more likely to be vaccinated because they are more receptive toward vaccination. Hence, the fifth and sixth hypotheses were:

5. Sexually active female college students will be more likely to be vaccinated, whereas female college students who have not had vaginal sex will be less likely to be vaccinated.
6. Sexually active female college students with more sexual partners will be more likely to be vaccinated.

It is important to focus on how young adults' protective behaviors are associated with HPV vaccine uptake because getting vaccinated is a healthy behavior. Using protection when having sex is a healthy behavior. Because HPV is an STI, condoms are one way to protect against transmission. The following is the seventh hypothesis, which I included to determine if female college students who endorsed healthy sexual behaviors also endorsed the healthy behavior of getting vaccinated against HPV:

7. Sexually active female college students who report using condoms more frequently will be more likely to be vaccinated.

Methods

Participants

I used data from the University Life Study (ULS), a longitudinal study of alcohol use and

sexual behavior at a large northeastern university. In 2007, we employed stratified random sampling with replacement to attain a sample diverse in gender and race/ethnicity. The sample was not meant to be representative of the university's student population, which includes a higher percentage of White students than ethnic or racial minority students. In order to be eligible for participation, participants had to be U.S. citizens or permanent residents entering their first year of college, reside within 25 miles of campus, and not turn 21 years old during the first wave of data collection. We mailed invitations to participate to eligible students with an informational letter about the study indicating when a link for participation would be emailed to the student, a pen, and a \$5 cash pre-incentive. Email invitations followed 5 days later with a secure link to the web surveys. Incentives for participation included the pre-study initial \$5 cash incentive and a \$20 incentive to complete the first semester survey. In total, 746 students (65.6% of those initially contacted, 50.8% female) completed the first semester survey. Participants completed the surveys once every semester following the first semester for a total of 7 semesters. The present study used data from female participants from the first, second, and third semesters. At Semester 2, 338 of the original 378 female students returned to complete the semester survey (89.4% retention rate from Semester 1). At Semester 3, 342 of the original female students returned to complete the semester survey (90.5% retention rate from Semester 1).

Because the present study focused on HPV vaccination status, I used responses only from female participants who answered the question about the HPV vaccine at Semester 3 as well as the predictor variables (described below). Due to missing data, a total sample of 308 female students was included in either or both models. The mean age of the analytic sample at Semester 1 was 18.4 years old ($SD = 0.4$). At Semester 1, participants were asked two separate questions regarding ethnicity (whether they were Hispanic/Latino) and race (participants were able to

choose more than one category). With regard to ethnicity, 27.9% of the analytic sample identified themselves as Hispanic/Latino. With regard to race, 25.6% identified themselves as African-American, 26.9% as Asian-American or Hawaiian/Pacific Islander, and 41.9% as European American. With regard to parental education, 6.1% of the analytic sample's mothers did not complete high school, 37.3% completed high school, 33.1% completed college, and 22.7% completed graduate school. In response to sexual orientation, 97.9% of the analytic sample identified themselves as heterosexual, 0.3% as homosexual, 1.6% as bisexual, and 0.3% as other.

I ran a series of four *t*-tests and five X^2 tests to determine if the analytic sample differed from the female students who dropped out of the study after Semester 1 or did not respond to the HPV vaccination question at Semester 3 with regard to demographics and the predictor variables (described below). The female students who completed the HPV vaccination question at Semester 3 did not differ from those who did not on mother's education, race/ethnicity, romantic relationship status, lifetime sex, number of partners, condom use, and health motivations against sex ($t_s < 1.1$, $X^2_s < 2.6$, $p_s > .05$).

In addition to conducting analyses on female participants who responded to the HPV vaccination question, I also selected only female participants who reported having vaginal sex in their lifetime (sexually active female students) ($N= 190$, 61.7% of the female students) at Semesters 1, 2, or 3 and who responded to the HPV vaccination question into a second analysis to address Hypotheses 6, and 7. I ran a series of one *t*-test and four X^2 tests comparing the sexually active female student sample to the larger female student sample on demographic variables to determine if differences existed between the two samples. The sexually active female student sample did not differ from the full sample on mother's education, and whether

they were African American, Asian/Pacific Islander, or European American ($t_s < .65$, $X^2_s < 2.0$, $p_s > .05$). The sexually active female student sample, did, however, differ from the female student sample in that the sexually active female student sample was more likely to be Hispanic, $X^2(1) = 5.5$, $p < .05$.

Measures

Semester 3 HPV Vaccination Status.

We determined *HPV vaccination status* by asking female students the following question at Semester 3: “Have you ever received a vaccine to help prevent HPV and cervical cancer (e.g., Gardasil)?”. Responses were yes (1) or no (0).

Romantic Relationship Status.

We assessed *romantic relationship status* by asking students “which of the following describes you right now?” with the responses not dating anyone, casually dating someone, in a committed relationship, living with their partner, engaged, or married at Semester 1, Semester 2, and Semester 3. I then dichotomized responses into “not in a serious relationship” (not dating anyone or casually dating someone) or “in a serious relationship” (in a committed relationship, living with their partner, engaged, or married). I combined responses across Semesters 1, 2, and 3 so that if participants ever responded “yes” to being in a serious relationship, they were coded as in a serious relationship. If participants said “no” to being in a serious relationship at all of the 3 time points, they were coded as not in a serious relationship. Of the analytic sample, 49.7% reported being in a serious relationship during at least one of the three semesters.

Lifetime Sex.

We assessed *lifetime sex* by asking the female students whether they had ever engaged in vaginal sex in their lifetime (yes = 1, no = 0). Students who responded they had not had lifetime

vaginal sex at any prior semester were asked the question at subsequent semesters. Once students responded as having had vaginal sex, they were not asked again at subsequent semesters. I combined responses across Semesters 1, 2, and 3 to combine all female students who had ever had vaginal sex.

Lifetime Number of Partners.

Female students who reported having vaginal sex were subsequently asked “In your lifetime, how many different partners have you had vaginal sex with?” (*lifetime number of partners*). Responses were open-ended. I split up responses into 3 categories: 0 partners, 1 partner, and 2 or more partners. This question was only asked in the semester that the female student reported ever having vaginal sex. Hence, there were data from participants who responded to the item at Semester 1, 2, and 3. Because there were data from each semester, I combined the responses from the female students across Semesters 1, 2, and 3 and then separated them into the 3 categories described above.

Condom Use.

We also asked sexually active female students about various sexual behaviors in the past 12 weeks. If sexually active female students responded “yes” to having vaginal and/or anal sex in the past 12 weeks, we asked an additional question about how frequently they used a condom (*12 week condom use*). Responses ranged from never (0) to every time (4). I used 12 week condom use as reported in Semester 3 for this study’s analysis because it is closest in time to the outcome variable, HPV vaccination.

Health Motivations Against Sex.

We assessed *health motivations against sex* using the 3 health motivation items from the Motivations Against Sex Questionnaire (MASQ) developed by Patrick, Maggs, Cooper, and Lee

(2010). The alpha for the scale in the current sample was $\alpha=0.88$. We asked female students to rate the extent to which the items were important to their decisions not to have sex, ranging from not at all (0) to very (4). The 3 items are “to avoid exposure to HIV/AIDS”, “worry about pregnancy”, and “because of a fear of STDs” (sexually transmitted diseases). I included responses to these items from Semester 3 because they were closest in time to the outcome variable, HPV vaccination.

Analyses

I performed 2 logistic regressions to determine the association between the predictors and HPV vaccination status.

The first logistic regression (referred to as Model 1) included all of the analytic sample. The variables included in the analysis were mother’s education, race/ethnicity, romantic relationship status, lifetime sex, and health motivations against sex. Because participants could select more than one response with regards to race/ethnicity, these variables were dummy-coded such that participants were given a “1” if they responded as being of the particular race and a “0” if they did not. For example, if a participant responded as being only African American, they were given a “1” for African American, “0” for Asian/Pacific Islander, “0” for Hispanic/Latino, and “0” for European American. This model addressed Hypotheses 1, 2, 3, 4, and 5.

The second logistic regression (referred to as Model 2) included the sub sample of sexually active female students. The variables included in the analysis were mother’s education, race/ethnicity, lifetime number of partners, and 12 week condom use. This logistic regression addressed Hypotheses 6 and 7.

Results

Overall, Model 1 was significant, $X^2(7) = 29.8, p < .001$. In support of research questions 1 and 2, mother's education and being African American were significantly associated with HPV vaccination (see Table 1). Female students whose mothers were more educated had a higher likelihood of getting vaccinated than female students whose mothers were less educated. In addition, African American female students had a lower likelihood of getting vaccinated than female students who were not African American. However, Hypotheses 3, 4, and 5 were not supported.

Model 2 was significant as well, $X^2(6) = 16.7, p < .05$. Mother's education and being African American were significantly associated with HPV vaccination (see Table 2). Similar to the findings for the full sample, sexually active female students whose mothers were more educated were more likely to get vaccinated against HPV and sexually active female students who were African American were less likely to get vaccinated against HPV. However, Hypotheses 6 and 7 were not supported.

Discussion

Overall, female college students and sexually active female college students were more likely to get vaccinated against HPV if their mothers were more educated and less likely to get vaccinated against HPV if they were African American. Previous research suggests an important predictor of getting vaccinated against HPV is having medical insurance (Conroy et al., 2009). It is possible that individuals whose mothers are highly educated have greater access to medical care and are more likely to be insured, and therefore, more likely to be vaccinated.

There have been little to no race differences in HPV vaccine acceptability demonstrated in previous research (Brewer & Fazekas, 2007); however, to my knowledge there has been no research examining racial/ethnic differences in actual HPV vaccine uptake. Attitudes toward HPV vaccination, such as HPV vaccine acceptability and motivations and intentions of getting vaccinated against HPV, may be different than actual HPV vaccine uptake in that the actual act of getting vaccinated requires factors other than opinion about the vaccine, such as access to medical care and ability to afford the vaccine. It is possible that African Americans are less likely to be insured or have access to the vaccine due to its cost and therefore are less likely to be vaccinated against HPV (Cui, Baldwin, Wiley, & Fielding, 2010; Shui, Kennedy, Wooten, Schwartz, & Gust, 2005). In general, research has shown that vaccination rates for other vaccines are lower among African Americans compared to other racial/ethnic groups (Sengupta et al., 2004). In addition to differences in healthcare access, the disparity in vaccination rates among African Americans when compared to other racial groups could be a reflection of lack of knowledge or awareness, concerns about vaccine safety, and/or vaccine distrust (Chen, Fox, Cantrell, Stockdale & Kagawa-Singer, 2007; Cui et al., 2010; Shui et al., 2005). African Americans report greater distrust of vaccinations and healthcare providers as well as concerns that vaccination may cause illness (Cui et al., 2010; Shui et al., 2005). Overall, female African Americans' lower likelihood of getting vaccinated against HPV warrants further study, particularly because of this population's disproportionately higher prevalence of cervical cancer (Cui et al., 2010).

The results suggest sexual experience is not associated with HPV vaccination. Therefore, women who are "at risk" for contracting HPV (those who are sexually active and those with multiple partners) are not more likely to get vaccinated against HPV, despite the fact that these

women are more accepting of the HPV vaccine (Gerend & Magloire, 2008; Jones & Cook, 2008). As previously stated, attitudes toward HPV vaccination, such as HPV vaccine acceptability and motivations and intentions of getting vaccinated against HPV, may be different than actual HPV vaccine uptake. Though sexual experience has been shown to be related to vaccine acceptability, the current findings suggest that it is unrelated to actual HPV vaccine uptake, possibly because HPV vaccine uptake is related more to demographic factors, like race and socioeconomic status.

In contrast to the hypotheses, women who do not perceive themselves as “at risk” (those in monogamous relationships and those who are not sexually active) were not less likely to get vaccinated against HPV. As previously stated, women in monogamous relationships are less likely to use condoms because they perceive themselves to be at lower risk of contracting an STI (Fazekas et al., 2001; Prince & Bernard, 1998). I did not find support for my hypothesis that women in monogamous relationships would also be less likely to be vaccinated against HPV than women not in monogamous relationships. This finding suggests that women in monogamous relationships may not view the HPV vaccine as solely protecting against STIs, especially because HPV vaccine is not tied to the actual act of having sex, unlike condoms. My findings suggest that regardless of sexual experience and perception of risk, young women are equally likely to get vaccinated against HPV.

Furthermore, there was no support for the hypotheses that healthy behaviors and attitudes toward sex (12 week condom use and greater health motivations against sex) were associated with a greater likelihood of being vaccinated against HPV for female college students. Although it is difficult to make conclusions based on null findings, one possible interpretation of this finding is that getting vaccinated against HPV is not viewed as just healthy or protective; rather,

getting vaccinated against HPV may be viewed as just another vaccination, like the tetanus or hepatitis shot.

There are several limitations of my study. One limitation is that I did not assess health insurance and access to medical care. Future research should assess these constructs in addition to the constructs I assessed because it is evident that these factors are important in HPV vaccination and vaccination in general. A second limitation is that I did not assess participants' knowledge and awareness of HPV and the HPV vaccine, both of which are important to HPV vaccine acceptability. Future research should include these constructs to determine their influence on HPV vaccine uptake. Another limitation is the way in which I measured romantic relationship status and lifetime vaginal sex partners. The romantic relationship status measure did not reflect whether the female student was in a relationship at the time of vaccination. Also, lifetime vaginal sex partners was only asked after the female student reported engaging in vaginal sex. Hence, this measure did not fully capture lifetime vaginal sex partners because the female student could have had more partners in subsequent semesters after they reported having vaginal sex. It is possible that results would have been different had these measures fully captured the construct. Also, my results cannot be generalized to same-aged non-college student populations because I employed a college student sample. Future research should study HPV vaccine uptake among college and non-college students. HPV vaccine uptake may be different among non-college students because non-college students may have their own health insurance, rather than relying on their parents', as well as their own financial means to pay for the vaccine. On the other hand, non-college students may be less privileged than college students because they may have no health insurance, limited access to medical care, and be low-income. Finally, another limitation is that I asked only female college students about HPV vaccination because at

the time of collection the vaccine was only approved for women. In 2009, Gardasil by the FDA for use for boys and men (Gardasil®, 2010). Future research should determine predictors of vaccination and behavior after vaccination among college men as well as women and how they are similar.

People, and parents of adolescents in particular, have expressed concern that vaccinating young women against HPV could lead them to engage in more risky sexual behaviors (Brewer, Cuite, Herrington & Weinstein, 2007; Marlow, Forster, Wardle & Waller, 2009). The argument is that vaccination may cause young women to feel less at risk, and as a consequence, engage in more risky sexual behavior, which in turn would increase their risk for cervical cancer and STIs. To make conclusions about the argument that getting vaccinated against HPV would lead one to engage in riskier behaviors, future research could employ a prospective design to assess behavior after HPV vaccination. To my knowledge, no research has examined the link between actual HPV vaccination and subsequent sexual behavior. Because the present study attempted to determine predictors of HPV vaccination, rather than behavior after HPV vaccination, conclusions about this argument could not be made. My findings suggest that there is no difference between female college students who are risky and female college students who are not in actual HPV vaccine uptake. Future research should determine whether my findings on behavior prior to HPV vaccination are replicated after HPV vaccination.

In addition, future studies assessing the HPV vaccine could include attitudes toward vaccination, like acceptability and intentions, and actual vaccine uptake in the same study to determine if attitudes toward HPV vaccination predict future HPV vaccine uptake. Also, future research should address moderators of HPV vaccine acceptability and uptake, such as whether or not an individual is insured or is sexually active moderates the relationship between HPV

vaccine acceptability and uptake. Likewise, other predictors should be assessed to determine their link to HPV vaccine uptake, such as religiosity and spirituality, knowledge of STIs in general, or other risky sex constructs, like frequency of sexual activity including vaginal sex, anal sex, and oral sex, and age at first intercourse.

Despite these limitations, this study contributes to the literature in several ways. The findings advance the literature on HPV vaccination because I assessed actual HPV vaccine uptake, whereas previous research primarily focuses on attitudes and intentions of getting vaccinated against HPV. In addition, I assessed constructs examined in previous studies determining HPV vaccine acceptability and intentions but examined their association to actual HPV vaccine uptake. I also included constructs associated with a healthy lifestyle, unlike previous research regarding the HPV vaccine. Finally, I employed a diverse sample with regard to race/ethnicity to determine if differences existed in HPV vaccine uptake. In particular, I examined Asian American female students, who are underrepresented in HPV literature compared to other races.

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Table 1

Logistic Regression Predicting HPV Vaccination From Demographic Variables, Romantic Relationship Status, Lifetime Sex, and Health Motivations Against Sex for Female College Students.

	B	SE B	Wald X ²	Odds Ratios
Mother's Education	.42	.10	17.67***	1.53
Black	-.68	.32	4.40*	0.51
Hispanic	.36	.31	1.33	1.43
Asian/Pacific Islander	-.09	.31	0.07	0.92
Romantic Relationship Status	.10	.27	0.14	1.11
Lifetime Sex	.27	.29	0.86	1.31
Health Motivations Against Sex	-.001	.09	0.00	1.00

*N=306; *p<.05; **p<.01; ***p<.001.*

Table 2

Logistic Regression Predicting HPV Vaccination From Demographic Variables, Number of Partners, and 12 Week Condom Use for Female College Students who had Vaginal Sex.

	B	SE B	Wald X ²	Odds Ratios
Mother's Education	.38	.12	9.56**	1.46
Black	-.82	.40	4.21*	0.44
Hispanic	-.03	.39	0.01	0.97
Asian/Pacific Islander	-.37	.42	0.78	0.69
Number of Partners	.14	.28	0.25	0.87
12 Week Condom Use	-.17	.31	0.32	0.84

*N=190; * $p < .05$; ** $p < .01$; *** $p < .001$.*

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