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Relationship Between HPV Vaccination and Sexual Activity, Sexual Health Care Utilization, and Perceived Risk

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RELATIONSHIP BETWEEN HPV VACCINATION AND SEXUAL ACTIVITY,

SEXUAL HEALTH CARE UTILIZATION, AND PERCEIVED RISK

by

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ABSTRACT
RELATIONSHIP BETWEEN HPV VACCINATION AND SEXUAL ACTITIVY,
HEALTH CARE UTILIZATION, AND PERCIEVED RISK

by

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The relationship between sexual activity, sexual health care utilization, and perceived risk

for HPV-related outcomes was examined in sample of college women, to explore recent

concerns that HPV vaccination may be related to an increase in risky sexual behaviors.

Vaccinated and not vaccinated women completed an anonymous, online survey including

age of vaccination, age at each sexual partner, condom use, use and intentions to use

sexual health care services, and perceptions of risk. Vaccinated women also reported

perceptions of change because of vaccination. Women were matched on age, race, and

poverty status. Number of partners since vaccination was calculated among the

vaccinated women as partners at or after age of vaccination. Number of partners since

vaccination for not vaccinated women was calculated using the age of vaccination of the

matched pair, to allow comparison across equivalent time intervals. Number of vaginal,

oral received, and anal partners were not different for vaccinated and not vaccinated

women. Although, after vaccination, women who received the vaccine reported

performing oral sex on a larger number of partners than not vaccinated women, the

number of vaginal, oral, and anal sex partners for which a condom was not used was not

different for vaccinated and not vaccinated women. Therefore, the number of partners

from which STI infection was likely was similar for all women. Although use of sexual

health care services since vaccination was not different for vaccinated and not vaccinated women, not vaccinated women reported higher intentions to receive a pelvic exam in the next year and a Pap smear in the next three years than vaccinated women. Intentions to receive an STI test in the next year were not different, however. Perceptions of risk for HPV-related outcomes were also not different for vaccinated and not vaccinated women. Among vaccinated women, the majority reported they had not changed their sexual activity, condom use, or use of health care services because of the vaccine. This study indicates that HPV vaccination is not related to greater risky sexual activity but that efforts to increase intentions to use sexual health care services among vaccinated women should be addressed.

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Genital human papillomavirus (HPV) is a sexually transmitted infection (STI) capable of infecting males and females through sexual activity including vaginal, penile, anal, or oral contact (US Department of Health and Human Services [HHS], 2012b). HPV is the most common STI in the United States (US) (Centers for Disease Control and Prevention [CDC], 2012), currently infecting approximately 79 million Americans, and the CDC estimates another 14 million people will become infected with HPV each year (CDC, 2013). Over 80% of sexually active women may contract HPV by the time they are 50 years old (CDC, 2007). Individuals are often unaware they have an HPV infection since the virus often presents no symptoms. The infection may persist for a few years and eventually go away without treatment (HHS, 2012b). In other cases, the HPV virus may persist for longer periods of time and may present symptoms such as genital warts or cervical cell changes.

There are over 40 types of genital HPV classified as low-risk and high-risk types. Two low-risk types, 6 and 11, cause 90% of cases of genital warts in males and females (HHS, 2012b). The high-risk types of HPV can cause cancer of the vulva, vagina, penis, anus, cervix, and head and neck. Two of these high-risk types, 16 and 18, cause 70% of cervical cancer cases and almost 50% of vaginal, vulvar, and penile cancers. HPV 16 also causes about 85% of anal cancer cases (HHS, 2012b).

The risk of cervical cancer from HPV infection is of great importance to health officials and has been in the forefront of HPV concerns since cervical cancer rates are much higher than the other cancer rates caused by HPV. In 2007, the year of the most recent estimates, 12,280 women in the US were diagnosed with cervical cancer and 4,021 women in the US died from cervical cancer (CDC, 2010b). HPV is found in 99% of

cervical cancer cases, with HPV types 16 and 18 being the *cause* of 70% of cervical

cancer cases (National Cervical Cancer Coalition [NCCC], 2012). The treatment of

genital warts and cervical cancer in the US each year is estimated to be $4 billion. The

cost of treatment for the other cancers caused by HPV increases this economic burden

even further (CDC, 2007).

In June 2006, the Food and Drug Administration (FDA) approved the Gardasil

vaccine, a series of three doses given over a period of six months, for girls aged nine

through 26 to protect against HPV types 6, 11, 16 and 18 (CDC, 2007). In 2007, the

Advisory Committee on Immunization Practices (ACIP) began recommending, and

continues to recommend, females age 11 through 12 receive the vaccine and females 13

through 26 receive a 'catch-up' vaccine if they did not receive it at a younger age (CDC,

2007).

In October 2009, the FDA approved a second brand of the HPV vaccine for

females 10 through 25 years, Cervarix. This vaccine protects against HPV types 16 and

18, but not against HPV types 6 and 11 (CDC, 2010a); thus it does not provide protection

from HPV-related genital warts. Like Gardasil, Cervarix is a series of three doses

administered over a six-month period. In 2010, ACIP modified its recommendation for

females 11 through 26 to include Cervarix (CDC, 2010a), so providers and patients can

choose either vaccine brand.

The benefits of the HPV vaccines are documented: vaccinating individuals against

HPV will slow its spread, reduce the prevalence of the disease, and thereby reduce the

prevalence of genital warts and cancers caused by HPV. Clinical trials with women

indicate that the HPV vaccine is 100% effective in preventing changes in cervical cells

and anal infection caused by HPV 16 or 18; it is also 98.9% effective in preventing external genital warts (NCCC, 2012). The vaccines do not treat HPV, however. For individuals already exposed to a strain of HPV, the vaccine cannot provide treatment. The vaccine will, however, still be effective against HPV strains the individual has not yet been exposed to (CDC, 2007). Therefore, the vaccine is most effective when the series of three doses are completed prior to initiation of sexual activity, when HPV infection is most likely to occur.

Despite literature on the benefits of the HPV vaccine and the CDC's recommendation for women to receive it, vaccination rates remain low in the US. The 2010 National Immunization Survey of the CDC shows that only 48.7% of girls age 13 through 17 in the US (and 54.4% in Wisconsin) have received at least one dose of the HPV vaccine and, among those, only 69.6% in the US (and 44.1% in Wisconsin) have received the complete set of three doses (CDC, 2011). These vaccination rates, both for the nation and Wisconsin, are well below Healthy People 2020's targeted goal for 80% of females 13 through 15 to receive all three doses of the HPV vaccine (HHS, 2012a). Research suggests several potential psychological and logistical barriers to HPV vaccine uptake.

Among these barriers, concerns about the relationship between HPV vaccination and sexual activity have been widely publicized in mass media as a reason against HPV vaccination (Bristol, 2007), and may be a contributor to low vaccination rates (Davis, Dickman, Ferris, & Dias, 2004; Zimet et al., 2005). Both newspapers and magazines have featured articles discussing a potential link between HPV vaccination and increased sexual activity (Gibbs, 2006; O'Rourke, 2007). This possible relationship has also been

in the forefront of the debate over mandatory HPV vaccination. When current Texas governor, Rick Perry, proposed mandatory HPV vaccination for young girls, a major component of the debate against it was the concern that HPV vaccination may encourage sexual promiscuity (Root, 2011). Similar fears have been noted in other states (Charo, 2007) and editorials have argued that the vaccine may give young girls permission to engage in sexual activity, that it will give them a false sense of security, and that it will lead them to be disinhibited toward sexual activity (Haber, Malow, & Zimet, 2007; Vamos, McDermott, & Daley, 2008). Likewise, a report in the Congressional Quarterly Researcher described the issue of HPV vaccination and its potential to encourage sexual activity, send an inconsistent message about sex, and be used as an excuse for promiscuity (Colin, 2007).

Beyond mass media, research has discussed the concerns about HPV vaccination and sexual activity for pediatricians, mothers, and young adult women. Although the relationship between HPV vaccination and sexual activity was not the initial focus of these studies, they nonetheless represent important background and support the need for further examination of the issue. Pediatricians perceived that potential barriers to HPV vaccination included parental concern that vaccination would lead to risky sexual activity (Kahn et al., 2005; Kahn et al., 2009) and that getting children vaccinated would "imply they condone premarital sex" (Kahn et al, 2009, p. 2327). Mothers reported concerns the vaccine would lead to an increase in risky sexual behaviors, promiscuity, and risk of other STIs because their daughters would believe they are protected against all STIs (Waller, Marlow, & Wardle, 2006; Perkins, Pierre-Joseph, Marquez, Iloka, & Clark, 2010). Similarly, female focus group participants 16-26 years were concerned the HPV

vaccine would lead women to discard condom use and give up cervical cancer screening due to a false sense of security from the vaccine (Mortensen, 2010). Mass media and research both suggest the concern about HPV vaccination and sexual activity is an important issue requiring investigation. However, past research has not clearly defined "risky sexual activity." It is necessary to clarify this term to further examine the possible relationship between HPV vaccination and sexual activity.

Several factors may contribute to risky sexual activity and should be examined in relation to HPV vaccination. Younger age of first sexual intercourse (Kaestle, Halpern, Miller, & Ford, 2005) and a higher number of sexual partners (Peterman et al., 2000) are associated with testing positive for an STI. Because the HPV vaccine provides no protection against other STIs, condom use and STI screenings remain important. Although the HPV vaccine does provide protection against HPV types responsible for 70% of cervical cancer cases, females can still become infected with HPV types not covered by the vaccine which are also capable of causing cervical cancer. Similarly, because the vaccine does not protect against the types of HPV already acquired, it remains important for females to continue with recommended cervical cancer screenings (CDC, 2007) if sexual initiation occurred before all three doses were received. Current recommendations are that women 21-29 years old receive a Pap smear every 3 years and women 30-65 receive a Pap smear every 5 years (American Cancer Society, 2012). Perceptions regarding risk of HPV, other STIs, and cervical cancer are also important factors to examine because of concern that decreased risk perceptions will lead to risky sexual behavior (Brabin et al., 2009).

Each of these sexual health issues supports the need for research on their potential relationship to HPV vaccination. If research suggests there is a link between HPV vaccination and increased sexual risk taking, or decreased sexual health care utilization, it may prompt a necessary increase in communication to women and health care providers about the importance of safe sex practices and sexual health care utilization. If no such relationship emerges, the data can be utilized to combat concerns and therefore attempt to increase HPV vaccination rates (Schuler, Reiter, Smith, & Brewer, 2011). Therefore, research is necessary to examine the relationship between HPV vaccination and sexual activity, sexual health care utilization, and perceptions of risk regarding HPV and other STIs.

Few studies have examined the relationship between HPV vaccination and sexual activity. Taylor, Hariri, Sternberg, Dunne, and Markowitz (2011) collected data regarding number of lifetime sex partners and number of sex partners in the past year. The authors defined sex broadly: as vaginal, anal, or oral. Results showed 14-26 year old women who had ever had sex were more likely to be vaccinated for HPV than those who had never had sex. Women who reported a higher number of sexual partners ever were also more likely to have received the HPV vaccine. For a subset of women, 11-18 year olds, those who reported higher numbers of sexual partners ever also reported higher rates of vaccination. Although these results appear to suggest there is a relationship between HPV vaccination and sexual activity, the scope of the study was only to identify associations between HPV vaccination and sexual behavior, no information was collected regarding the timing of receipt of vaccines in respect to sexual activity. Therefore, no conclusions can be drawn about whether sexual activity increased more for vaccinated women than

not vaccinated women. Instead, the results could be explained by the fact that women who are more sexually active prior to vaccination were more likely to receive the vaccine.

Liddon, Leichliter, and Markowitz (2012) also examined the relationship between HPV vaccination and sexual activity, but reported different results than Taylor et al. (2011). Data was collected regarding age of first vaginal intercourse, number of lifetime partners, condom use consistency in the past four weeks, and receipt of a Pap smear and STI service in the past year. Their study revealed that, among 15-19 year olds, those who reported always or sometimes using condoms were more likely to be vaccinated than those who reported never using a condom. HPV vaccination was unrelated to having had vaginal intercourse, age at first intercourse (for 15-19 year olds only), number of sexual partners ever, consistency of condom use in the past four weeks (20-24 year olds only), receiving STI services in the past year, and having a Pap smear in the last year (for 20-24 years olds only). For 20-24 year olds, age at first vaginal intercourse and receipt of a Pap smear in the past year were unrelated to HPV vaccination when other variables were controlled for. As with Taylor et al. (2011), the purpose of this study was to examine associations between HPV vaccination and sexual behavior, so no data was collected about the age of HPV vaccination. Therefore, no conclusions can be made about sexual activity before and after vaccination. Instead, results suggest that, for a subset of women, those who receive the HPV vaccine may actually report safer sexual practices: more women who report always or consistently using a condom are vaccinated than those who report never using a condom.

These studies were conducted in 2006-2008 (Liddon et al., 2012) and 2007-2008 (Taylor et al., 2011), shortly after the first HPV vaccine was approved by the FDA in 2006 and recommended by ACIP in 2007. Current research is needed to explore the relationship between HPV vaccination and sexual practices since previous research was conducted on women who received the HPV vaccine only shortly after its approval. Early adopters of the HPV vaccine may have been sexually active at younger ages, had more sexual partners before vaccination, or had more safety concerns than those who waited a few years before receiving the vaccine, and therefore may have been more accepting of the vaccine. Current research in needed that also includes later adopters of the vaccine. Additionally, past research did not distinguish between sexual acts (vaginal, oral, and anal intercourse), which is important since they present different magnitudes of risk for infection of STIs. Similarly, those who do not perceive oral or anal acts as "sex" may be less likely to protect themselves against STIs related to those acts. Finally, past research has not examined the relationship between HPV vaccination and discontinuation of sexual health care utilization and perceptions of risk. The current study seeks to overcome the limitations of previous research by providing more recent and comprehensive results about the relationship between HPV vaccination and sexual activity, sexual health care utilization, and perceptions of risk.

The Current Study

The current study examined, within a sample of college women, the relationship between HPV vaccination and sexual activity, sexual health care utilization and intentions, and perceptions of risk regarding HPV and other STIs. This study advances past research regarding the potential relationship between these factors by collecting

more precise information about age at each new sexual partner and age at vaccination. This additional data allowed for greater analysis of the number of new sexual partners, condom usage, and sexual health care utilization since vaccination. Women who have never received the HPV vaccine (not vaccinated) or have received some or all of the doses (vaccinated) reported information about their sexual partners, sexual practices, use of sexual health care services since vaccination as well as intentions to use sexual health care services, perceptions of change because of vaccination, and perceptions of risk. Emerging research suggests one or two doses of the HPV vaccine are efficacious at protecting against HPV types 16 and 18 (Kreimer et al., 2011) and therefore provides support for analyzing vaccination status as a dichotomous variable. The primary research goals were to examine whether differences exist between women vaccinated and not vaccinated against HPV in (1) sexual partners and condom use since vaccination, (2) use and intentions to use sexual health care services since vaccination, and (3) perceptions of risk and importance of sexual health care use after vaccination. The final goal (4) was to measure the perceptions of change because of vaccination among vaccinated women.

Method

Survey

Survey items were adapted from several measures used in previous research. Question wording was adjusted for easy comprehension in an online, self-administered format. Survey items were reviewed for comprehension and completeness by a team with experience in sexual health and health psychology research.

Sexual activity. The survey included items to assess number of sexual partners (e.g., "In your lifetime, how many men have you had vaginal intercourse with?"), age of

first intercourse with each new partner (e.g., "What age were you when you had vaginal

intercourse with the 1st man?"), and condom use frequency with each partner (e.g., "How

often did you use condoms during vaginal intercourse with the 1st man?" and "How often

did you use a dental damn when the 1st man performed oral sex on you?"). Responses of

condom use frequency were reported on a 5-point Likert scale (1 = *Never*, 5 = *Always*).

Women reported total number of partners, age at first sex with each partner, and condom

use with each partner for each type of intercourse: vaginal intercourse, oral sex

performed, oral sex received, and anal sex. Items on number of sexual partners and age at

intercourse were adapted from the National Health and Nutrition Examination Survey

2009, used by the CDC for data collection in the two previous studies regarding HPV

vaccination and sexual activity (Taylor et al., 2011; Liddon et al., 2012). Frequency of

condom use items were adapted from the survey used by Beadnell et al. (2005) for data

collection regarding sexual risk-taking.

Sexual health care utilization. The survey included items to assess utilization of

and intent to use sexual health care services including pelvic exams, Pap smears, and STI

testing (e.g., "How many times have you had a Pap smear in the last 3 years?" and "How

many times do you intend to have a Pap smear in the next 3 years?"). The item measuring

intention to get tested for an STI was adapted from Boyer, Sieverding, Siller, Gallaread,

& Chang's (2007) research on STI screening. All other items were adapted from the

NHANES survey.

Perceptions of risk. The survey included items related to perceptions of risk of

cervical cancer, genital warts, HPV, and other STIs (e.g., "How likely do you think you

are to get HPV in your lifetime?"). Responses were reported on a 5-point Likert scale (1 =

Very unlikely, 5 = *Very likely*). The survey also included items related to the perceived importance of pelvic exams, Pap smears, STI testing, and condom use (e.g., "How important do you think it is to use condoms during vaginal intercourse?"). Responses were reported on a 5-point Likert scale (1 = *Not important*, 5 = *Very important*). Perception of risk items were adapted from research on perceived risk for AIDS (Hansen, Hahn, & Wolkenstein, 1990).

Perceptions of change. The survey included items assessing women's perception of change in condom use because of the vaccine (e.g., "Because you have received the HPV vaccine, have you changed how often you use condoms during vaginal intercourse?"), change in sexual health care utilization because of the vaccine (e.g., "Because you have received the HPV vaccine, have you changed how often you get a Pap smear?"), and change in beliefs about STI susceptibility because of the vaccine (e.g., "Because you have received the HPV vaccine, has your belief regarding how protected you are from sexually transmitted diseases or infections (other than HPV) changed?"). Perception items were answered at the end of the survey so they would not influence the reporting of actual behaviors. Women could not return to previous sections of the survey to adjust their answer of actual behaviors.

Demographics. The survey collected demographics and information pertaining to HPV vaccination: brand of vaccination, number of doses received, and age at most recent dose.

Procedure

The study was approved by the University of Wisconsin – Milwaukee's IRB. Female students, between the ages of 18 and 32, who were enrolled in a course at the

University of Wisconsin – Milwaukee (UWM) that allowed extra credit for research participation, were invited to complete a survey. UWM is a large, diverse campus in which students from all ethnicities, socioeconomic statuses, and religions are enrolled. This specific age range was targeted because women who were 26 years old when the vaccine first became available, and were therefore the oldest women for whom the vaccine was approved, would at the time of this survey be 32 years of age. Participants were recruited through SONA, a human subjects pool management system, used by the university, and were directed toward an online survey. The first screen of the online survey was a consent form in which participants were informed the survey was collecting information regarding sexual activity but that no identifying information would be linked to their survey. Participants gave their consent for the survey by clicking to the next screen. Participants completed the survey in about 15 minutes and received extra credit.

Statistical Analyses

All data were analyzed with SPSS 17.0. Heterosexual women across groups (vaccinated and not vaccinated) were matched on age, race/ethnicity, and poverty. For instances in which multiple responses could serve as a match, one response was randomly selected. Women were not directly asked how many partners they had before and after vaccination. Instead, the age of each partner was reported. The number of sexual partners before vaccination was calculated by adding the number of partners before the age of vaccination. Partners reported at or after the age of vaccination were totaled to calculate the number of partners since vaccination. Number of sexual partners for the not vaccinated women was calculated using the matched pair's age of vaccination: this allowed for both vaccinated and not vaccinated women to have an equivalent number of

years since vaccination. A similar method was used to calculate number of partners without a condom before and after vaccination.

To determine if vaccinated and not vaccinated women differed in sexual practices after age of vaccination (Goal 1), paired-samples t-tests were conducted to compare number of new partners since vaccination, and number of new partners for which a condom was not used since vaccination. Analysis was conducted separately for vaginal, oral performed, oral received, and anal intercourse.

To analyze sexual health care utilization (Goal 2), paired-samples t-tests were conducted on variables measuring number of pelvic exams in the last year, and number of Pap smears in the last three years. To ensure reported pelvic exams and Pap smears occurred after vaccination, these analyses included only those women who were vaccinated one or three full years prior completing the survey. Paired-samples t-tests were conducted to analyze intention to use sexual health care among all vaccinated and not vaccinated women: how likely participants were to get a pelvic exam in the next year, a Pap smear in the next 3 years, and tested for an STI in the next year.

Three items related to HPV risk perception (HPV, genital warts, and cervical cancer) and one item of STI risk perception were averaged to form the scale *risk perception*. Scale reliability ($\alpha = .822$) was sufficient (Nunnaly, 1978). The six perceived importance items (to get a pelvic exam every year, get a Pap smear every 3 years, to get tested for STIs, use condoms during vaginal sex, use condoms during oral sex, and use condoms during anal sex) were averaged to form a scale representing *perceived importance of sexual health*. The scale reliability ($\alpha = .756$) was sufficient. Paired-

samples t-tests were conducted to assess differences between groups using the resulting scales of *risk perceptions* and *perceived importance of sexual health* (Goal 3).

Frequencies were conducted on items related to perceived change in condom use and sexual health care utilization (Goal 4) to measure whether women who were vaccinated believed they changed their behaviors because of the vaccine. T-tests were conducted on outcome variables (for each goal) to measure whether, among vaccinated women, those vaccinated before and after age 18 differed.

All dependent variables were non-normal except for age at first sexual intercourse. Natural log transformations of all non-normal variables resulted in normal distributions, therefore meeting the assumption of normality. Analyses were conducted on both raw and transformed data. Results report statistics of raw data for ease of comprehension when results from raw and transformed data yield similar results. Any discrepant results between raw and transformed data are described. Because violation of the assumption of normality may affect power to detect differences, results from transformed data are more precise in these instances. Statistics based on unequal variances are reported for any instances in which the assumption of equality of variances is violated. Since each woman completed the survey only one time, all measurements are assumed to be statistically independent of each other, and therefore the assumption of independent scores was met.

Results

Participants

Seven hundred women completed the survey. After removing responses with missing data on fields required for matching, the remaining 644 responses were matched

on age, race, and poverty status, yielding 156 pairs of heterosexual women (312 responses). Each pair of responses contained one woman who did not receive the vaccine and one woman who did receive the vaccine. After checking for outliers, three responses and their pair were removed.

Demographics were analyzed for the 153 remaining pairs; 141 contained a woman who received all three doses of the vaccine, seven contained a woman who received two doses, and five contained a woman who received one dose. Of those who did not receive all three doses, five women did not give a reason, three were unsure why they never got all three doses, two were still waiting the required time between doses, one forgot to get all three doses, and one was unable to pay for the last two doses. Most vaccinated women received the Gardasil vaccine (75.9%), one woman received Cervarix (0.6%), and many women did not know what brand was received (22.2%). First doses of vaccines were received at pediatrician offices (53.6%), gynecologic offices (28.2%), primary care physician offices (9.1%), state health department clinics (7.3%), and Planned Parenthood clinics (1.8%). Women were vaccinated because their parents got them vaccinated (33.8%), a nurse, doctor, or other health care personnel recommended it (31.9%), and because the woman wanted to get it (25.5%). Vaccination age ranged from 12 to 26 ($M = 17.48$, $SD = 1.98$). The majority of vaccinated women received the vaccine before vaginal intercourse (57.4%), performing oral sex (59.9%), receiving oral sex (61.2%), and anal sex (94.6%).

For each group (vaccinated and not vaccinated), participants age ranged from 18 to 28, with mean age of 19.90 ($SD = 1.84$). The majority of women were Caucasian (80.1%). African American (11.4%), Asian (4.7%), Hispanic (2.5%), American Indian

(0.6%), and mixed race (0.6%) represented smaller proportions of the sample. About half (46.5%) of the women qualified for Federal Pell Grants, an indicator of poverty. All women were never married. Religion, health insurance type, and home setting classification are reported in Table 1 for vaccinated and not vaccinated women. Most women were Christian, held private health insurance, and lived in a suburban setting. Vaccinated and not vaccinated women did not differ on any of these demographics.

Responses from women who reported they had never had vaginal intercourse (and those women's matched pair) were removed before analysis of the outcome variables because those questions were not pertinent to women with no sexual experience: 17.2% of not vaccinated and 15.8% of vaccinated women reported zero vaginal intercourse partners. After removing these 96 participants, 105 pairs (210 responses) were included in the analysis of the outcome variables.

Women's history of sexual activity ever and before vaccination is reported in Table 2. The only difference was that vaccinated women had a significantly higher number of vaginal sex partners ever than not vaccinated women, $t(104) = 3.14$, $p = .002$. Vaccinated and not vaccinated women were not different ages at first vaginal intercourse ($t(78) = -1.52$, $p = .133$), first time performing oral sex ($t(67) = -.57$, $p = .568$), first time receiving oral sex ($t(68) = -.05$, $p = .959$), or at first anal sex ($t(2) = -2.00$, $p = .184$). Vaccinated and not vaccinated women did not have different numbers of partners on which oral sex was performed ($t(94) = .89$, $p = .375$), from which oral sex was received ($t(102) = 1.15$, $p = .253$), or anal sex ($t(92) = -1.35$, $p = .179$). Before vaccination, women who were and were not vaccinated did not have different numbers of vaginal sex partners ($t(78) = 1.38$, $p = .170$), men they performed oral sex on ($t(76) = .05$, $p = .963$), men from

which they received oral sex ($t(77) = .00$, $p = 1.000$), or anal sex partners ($t(72) = -.85$, $p = .397$). Vaccinated and not vaccinated women did not have different numbers of men ever with which they had not used a condom or dental dam at least once during vaginal sex ($t(15) = .57$, $p = .579$), oral sex performed ($t(12) = -1.82$, $p = .094$), or oral sex received ($t(9) = -.20$, $p = .843$). The low numbers of women who had anal sex provided insufficient data to allow analysis of condom use during anal sex. Before vaccination, women who were and were not vaccinated did not have different numbers of partners with which a condom or dental dam was not used during vaginal sex ($t(22) = .49$, $p = .632$), oral sex performed ($t(19) = .14$, $p = .894$), or oral sex received ($t(17) = .00$, $p = 1.000$). The low numbers of women who had anal sex provided insufficient data to allow analysis of condom use during anal sex before vaccination.

Vaccinated and not vaccinated women did not differ on use of sexual health care services ever. Vaccinated women ($M = 2.43$, $SD = 2.83$) were not tested for STIs a different number of times than not vaccinated women ($M = 2.05$, $SD = 5.11$), $t(104) = .77$, $p = .446$. Women who were ($M = .21$, $SD = .41$) and were not vaccinated ($M = .23$, $SD = .68$) were not diagnosed with a different number of STIs, $t(50) = -.20$, $p = .844$. After natural log transformations, women who were vaccinated ($M = 1.10$, $SD = .79$) did not receive a different number of pelvic exams ever than women who were not vaccinated ($M = .89$, $SD = .80$), $t(54) = 1.63$, $p = .109$. After natural log transformations, however, vaccinated women ($M = 1.08$, $SD = .88$) received a marginally higher number of Pap smears ever than not vaccinated women ($M = .83$, $SD = .75$), $t(47) = 1.86$, $p = .070$.

Sexual Activity (Goal 1)

      Number of partners after vaccination. Means and standard deviations of sexual activity after vaccination are reported in Table 3. After vaccination, women who were vaccinated reported more vaginal sex partners than women who were not vaccinated, $t(78) = 2.36$, $p = .021$. After vaccination, women who were and were not vaccinated did not have different numbers of men they performed oral sex on ($t(76) = .88$, $p = .383$), received oral sex from ($t(77) = 1.33$, $p = .189$), or anal sex partners ($t(75) = -1.59$, $p = .116$).

      Among vaccinated women, those who received the vaccine before age 18 and therefore needed parental consent did not report different numbers of partners for vaginal intercourse ($t(100) = 1.644$, $p = .103$), oral sex received after natural log transformations ($t(82) = .550$, $p = .584$), and anal sex after natural log transformations ($t(14.846) = 1.307$, $p = .211$) than women vaccinated after age 18 and not needing parental consent. After natural log transformations, women vaccinated before age 18 ($M = .96$, $SD = .81$) reported a higher number of oral sex performed partners than women vaccinated after age 18 ($M = .58$, $SD = .66$), $t(73.492) = 2.342$, $p = .022$.

      Number of partners without a condom after vaccination. Women who were and were not vaccinated did not have different numbers of partners with which a condom or dental dam was not used during vaginal sex ($t(67) = 1.49$, $p = .140$), oral sex performed ($t(56) = 1.21$, $p = .231$), oral sex received ($t(53) = 1.07$, $p = .290$), or anal sex ($t(1) = 1.00$, $p = .500$).

      Among vaccinated women, those who were vaccinated before and after age 18 did not report different numbers of partners without a condom after vaccination for

vaginal intercourse (t(94) = 1.323, p = .189), oral sex received (t(80.958) = 1.575, p = .119), or anal sex (t(14) = 1.284, p = .220). Women vaccinated before age 18 (M = 3.63, SD = 3.05) reported higher numbers of oral sex performed partners without a condom than women vaccinated after age 18 (M = 2.26, SD = 1.84), t(80.000) = 2.536, p = .013).

Sexual Health Care Utilization (Goal 2)

    Pelvic exams. After correcting for non-normality of data through natural log transformations, vaccinated women (M = .15, SD = .33) did not receive a different number of pelvic exams in the past year than not vaccinated women (M = .08, SD = .29), t(32) = .88, p = .388.

    Among vaccinated women, those vaccinated after age 18 (M = 1.09, SD = .77) reported receiving more pelvic exams in the last year than women vaccinated before age 18 (M = .75, SD = .52), t(82) = -2.462, p = .016.

    Pap smears. Vaccinated women (M = 1.88, SD = 1.52) did not receive a different number of Pap smears in the past three years than not vaccinated women (M = 1.42, SD = 1.20), t(32) = 1.59, p = .121.

    Among vaccinated women and after natural log transformations to correct for non-normality of data, those who received the vaccine after age 18 (M = 1.17, SD = .47) reported marginally higher numbers of Pap smears in the last three years than women who received the vaccine before age 18 (M = .62, SD = .54) , t(20) = -1.896, p = .072.

    Intentions to utilize. Women not vaccinated (M = 4.16, SD = 1.11) reported higher intentions to get a pelvic exam in the next year than vaccinated women (M = 3.79, SD = 1.36) (t(102) = 2.21, p = .029). After log transformations, women not vaccinated (M = .33, SD = .49) reported higher intentions to receive a Pap smear in the next three years

than vaccinated women ($M = .20$, $SD = .40$), $t(102) = -2.07$, $p = .041$. After log transformations, vaccinated women ($M = .64$, $SD = .60$) reported marginally higher intentions to get tested for an STI in the next year than women not vaccinated ($M = .77$, $SD = .65$), $t(103) = -1.67$, $p = .098$.

Among vaccinated women, those who received the vaccine before ($M = 3.98$, $SD = 1.12$) and after ($M = 4.31$, $SD = 1.05$) age 18 did not reported different intentions to get a pelvic exam in the next year, $t(108) = -1.548$, $p = .125$. After correcting for non-normality, women vaccinated after age 18 reported marginally higher intentions to receive a Pap smear in the next three years ($t(107.865) = -1.755$, $p = .082$) and STIs in the next year ($t(108) = -1.676$), $p = .097$) than women vaccinated before age 18.

Perceptions of Risk (Goal 3)

Women who were ($M = 1.96$, $SD = .88$) and were not ($M = 2.11$, $SD = .92$) vaccinated did not report different perceptions of risk for HPV-related outcomes and STI infection, $t(102) = -1.24$, $p = .218$. Vaccinated women ($M = 4.87$, $SD = .71$) reported higher perceived importance of sexual health care than women not vaccinated ($M = 4.40$, $SD = 1.00$), $t(101) = 4.16$, $p < .001$.

Among vaccinated women, those who received the vaccine before and after age 18 did not report different perceptions of risk for HPV-related outcomes ($t(106) = -1.460$, $p = .147$) and similar perceived importance of sexual health care ($t(106) = -1.163$, $p = .248$).

Perceptions of Change (Goal 4)

Sexual activity. The majority of vaccinated women reported they had not changed their use of condoms or sexual health care utilization because of receiving the

HPV vaccine. Few vaccinated women reported they use condoms less often because of the vaccine during vaginal (2.9%), oral (1.0%), and anal sex (0.0%). Some women reported they used condoms *more* often because of the vaccine during vaginal (10.5%), oral (1.9%), and anal sex (1.0%). Women vaccinated before and after age 18 did not report different change in condom use during vaginal ($t(108) = -.189$, $p = .851$), oral ($t(108) = -.180$, $p = .858$), and anal sex ($t(108) = .895$, $p = .373$).

Sexual health care utilization. Few vaccinated women reported they get tested for an STI less often because of the vaccine (1.0%), get pelvic exams less often because of the vaccine (1.0%), and get Pap smears less often because of the vaccine (0.0%). Some women reported they get tested for an STI *more* often because of the vaccine (2.9%), get pelvic exams *more* often because of the vaccine (1.0%), and get Pap smears *more* often because of the vaccine (1.9%). Women vaccinated before and after age 18 did not report different change in frequency of pelvic exams ($t(108) = .303$, $p = .763$) and Pap smears ($t(108) = .303$, $p = .763$).

Perceived risk. Because of the HPV vaccine, 19.0% of vaccinated women reported they believed they were more protected from STIs (other than HPV) than they were before getting vaccinated. Women who believed they were more protected from STIs other than HPV were similar age and race, and had similar education, religion, and poverty status than women who did not believe they were more protected from STIs other than HPV. These women were also similar ages at vaccination: women who received the vaccine before and after age 18 reported similar change in perceived protection, $t(108) = -.571$, $p = .569$. No women believed they were less protected.

Discussion

This study examined the relationship between HPV vaccination and sexual activity, sexual health care utilization and intentions to utilize, perceptions of risk for HPV related outcomes, and perceived change in sexual behaviors and health care utilization. It is the first study to collect data on specific ages of each sexual partner and age of vaccination to allow for analysis of sexual behaviors after HPV vaccination. This is of particular importance as concerns arise regarding HPV vaccination's relationship to sexual activity and sexual health care utilization (Bristol, 2007; Davis et al., 2004; Gibbs, 2006; Root, 2011; Charo, 2007; Haber et al., 2007).

Goal one tested for differences between vaccinated and not vaccinated women in number of sexual partners and condom use frequency after vaccination. Results showed that vaccinated women had a higher number of vaginal sex partners than not vaccinated women. Number of oral sex and anal sex partners were similar, as was condom use frequency for vaginal, oral, and anal sex. A larger number of vaginal sex partners among vaccinated women may provide some support for the concern that HPV vaccination is related to greater sexual activity, and therefore some support for greater communication with vaccine recipients about the continued importance of safe sex practices. Greater number of sexual partners, however, is not directly indicative of greater risky sexual activity. Condom usage during sexual acts and STI testing between partners may provide protection for any increase in risk that a higher number of sexual partners would introduce. Since number of partners without a condom is similar between vaccinated and not vaccinated women, the number of partners during which STI infection is likely is

similar for the women. It is likely, then, that vaccinated and unvaccinated women's sexual activity does not put them at differing risks for sexual health concerns.

Goal two tested for differences between vaccinated and not vaccinated women in use of sexual health care services since vaccination and intentions to use sexual health care services in the future. Vaccinated and not vaccinated women had similar use of sexual health care services since vaccination and similar intentions to get tested for STIs in the next year. Not vaccinated women did, however, report higher intentions to receive a pelvic exam in the next year and a Pap smear in the next three years. This difference in intentions to receive a pelvic exam and Pap smear may be cause for concern and may warrant a need for increased communication about the continued importance of sexual health care services.

It is unclear if these intentions to use sexual health care services will lead to actual use of services. The Theory of Planned Behavior (Ajzen, 1991) suggests a relationship between intentions and behavior, but future research should study, prospectively, the use of sexual health care services in women vaccinated and not vaccinated against HPV.

Goal three was to examine the perceptions of risk and perceived importance of sexual health between vaccinated and not vaccinated women. Although women reported similar perceptions of risk for HPV and HPV-related outcomes, vaccinated women reported higher importance of sexual health than women not vaccinated. This may be an indication that women who receive the vaccine do so because they perceive sexual health to be of higher importance than not vaccinated women. Future research should study, prospectively, perceived importance of sexual health in women before and after receipt of the HPV vaccine.

Goal four focused on measuring perceptions of change among vaccinated women. The majority of vaccinated women reported they had not changed their use of condoms because of the vaccine, nor did they change how often they got pelvic exams or Pap smears. This finding suggests that vaccinated women continue to perceive condom use and sexual health care utilization as important aspects of continued sexual health, despite HPV vaccination status.

Overall, the results from this study indicate that HPV vaccination is not related to greater risky sexual activity or less use of sexual health care services: HPV vaccination was not related to earlier sexual debut, decreased condom use, or decreased use of sexual health care services such as pelvic exams, Pap smears, and STI testing. Vaccinated women may, however, be less likely to utilize sexual health care services in the future. These findings may allay concerns about HPV vaccination being linked to increased risky sexual activity, but may also highlight the need for education about the need for continued use of sexual health care services.

This study also examined the differences between women vaccinated before age 18, when parental consent was required, and after age 18. Since parental consent is not required after age 18, women vaccinated after that age are less likely to have received the vaccine merely because their parents wanted them to get it. Women vaccinated after age 18 reported lower numbers of men they performed oral sex on without a condom, and higher numbers of pelvic exams and Pap smears in the past. Women vaccinated before and after age 18 reported similar perceptions of risk; importance of sexual health care; and perceptions of change in sexual activity, sexual health care utilization and perceptions of risk since vaccination. The higher rates of protected oral sex and sexual

health care utilization in women vaccinated after age 18 may be because the women who sought out the vaccine without needing parental consent may be women who take more initiative in their sexual health.

This study's limitations include those related to retrospective data collection and, as in research related to the reporting of sexual behaviors, a potential for underreporting of sexual behavior. Because women reported sexual activity and sexual health care utilization retrospectively, recall error is a potential issue for both vaccinated and not vaccinated women. Further research measuring activity prospectively should be conducted. Because this was a survey measuring sexual activity, underreporting is a potential limitation due to the reporting of socially undesirable behaviors. This survey, however, was conducted in an anonymous, online format, with question descriptions designed to minimize reporting error (e.g., "Some people use condoms during vaginal intercourse to prevent disease or pregnancy. Others do not use condoms. The following questions ask how often you used condoms when you had vaginal intercourse with each man").

Despite limitations and the need for further research, this study provides an important foundation for educational efforts related to HPV vaccination. This study supports the need for increased communication that HPV vaccination does not lead to risky sexual behaviors and the need for increased communication about utilization of sexual health care services. Further research should examine women who believe, that because of the HPV vaccine, they are more protected from STIs other than HPV. Although this study did not find any associations with that belief, it was not the aim of the study.

Table 1

Religion, Health Insurance, and Home Setting by Vaccination Status

Variable	Vaccinated %	Not Vaccinated %
Religion		
Christianity	63.6	60.4
None	29.1	36.8
Other	7.3	2.8
Health Insurance		
Private	71.8	62.3
Government-Assisted	19.1	26.4
None	9.1	11.3
Home Setting		
Urban	26.4	30.2
Suburban	41.8	45.3
Rural	31.8	24.5

Table 2

Means and Standard Deviations of Sexual Behaviors Ever and Before Vaccination by

HPV Vaccination Status

Variable	Vaccinated		Not Vaccinated	
	M	*SD*	*M*	*SD*
Age of first sexual experience				
Vaginal	16.54	1.56	16.92	1.68
Oral Received	16.96	1.77	16.97	1.50
Oral Performed	16.60	1.70	16.70	1.52
Anal	18.00	1.73	18.67	1.53
Number of sexual partners ever				
Vaginal*	5.48	4.55	3.87	3.56
Oral Received	3.26	3.00	2.82	2.99
Oral Performed	3.89	3.87	3.48	3.30
Anal	0.31	0.68	0.46	0.77
Number of partners before vaccination				
Vaginal	1.54	2.60	1.20	1.90
Oral Received	1.04	1.92	1.04	1.90
Oral Performed	1.35	2.43	1.34	2.09
Anal	0.07	0.30	0.12	0.44
Number of sexual partners without a condom ever				
Vaginal	4.44	5.69	3.56	2.73
Oral Received	6.00	4.57	6.30	4.40
Oral Performed	5.38	2.93	7.08	3.88
Anal	2.00	0.00	2.00	1.41
Number of partners without a condom before vaccination				
Vaginal	1.87	3.12	1.57	1.75
Oral Received	2.83	3.05	2.83	2.66
Oral Performed	3.55	3.12	3.45	2.48
Anal	1.86	2.79	1.33	0.82

Note. All variables measuring the number of partners of number of partners without a condom were calculated from reported age and condom use of each partner.
* $p < .05$.

Table 3

Means and Standard Deviations of Sexual Behaviors after Vaccination by Vaccination Status

	Vaccinated		Not Vaccinated	
Variable	*M*	*SD*	*M*	*SD*
Number of partners after vaccination				
Vaginal*	3.80	3.62	2.72	2.61
Oral Received	2.32	2.26	1.87	1.93
Oral Performed	2.49	2.50	2.16	2.31
Anal	0.20	0.54	0.36	0.63
Number of partners without condom after vaccination				
Vaginal	2.03	2.54	1.50	1.70
Oral Received	2.67	1.74	2.28	2.00
Oral Performed	2.88	2.23	2.39	2.17
Anal	1.50	0.71	0.50	0.71

Note. All variables were calculated from reported age and condom use of each partner.
* $p < .05$.

References

Ajzen, A. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211.

American Cancer Society. (June 16, 2012). *American Cancer Society Guidelines for the Early Detection of Cancer.* Retrieved from http://www.cancer.org/Healthy/FindCancerEarly/CancerScreeningGuidelines/american-cancer-society-guidelines-for-the-early-detection-of-cancer

Beadnell, D., Morrison, D. M., Wilsdon, A., Wells, A. W., Murowchick, E., Hoppe, M. . . Nahom, D. (2005). Condom use, frequency of sex, and number of partners: Multidimensional characterization of adolescent sexual risk-taking. *The Journal of Sex Research, 42*(3), 192-202.

Boyer, C. B., Sieverding, J., Siller, J., Gallaread, A., & Chang, Y. J. (2007). Youth united through health education: Community-level, peer-led outreach to increase awareness and improve noninvasince sexually transmitted infection screening in urban African American youth. *Journal of Adolescent Health, 20*, 499-505.

Brabin, L., Roberts, S. A., Stretch, R., Daxter, D., Elton, P., Kitchener, H., & McCann, R. (2009). A survey of adolescent experiences of human papillomavirus vaccination in the Manchester study. *British Journal of Cancer, 101*(9), 1502-1504.

Bristol, N. (2007). HPV vaccine: The issues. *Congressional Quarterly Researcher, 17*(18), 411-428.

Centers for Disease Control and Prevention. (2007). Quadrivalent human papillomavirus vaccine: Recommendations of the Advisory Committee on Immunization Practices. *Morbidity and Mortality Weekly Report, 56*(2), 1-24.

Centers for Disease Control and Prevention. (2010a). FDA licensure of bivalent human papillomavirus vaccine (HPV2, Cervarix) for use in females and updated HPV vaccination recommendations from the Advisory Committee on Immunization Practices (ACIP). *Morbidity and Mortality Weekly Report, 59*(20), 626-629.

Centers for Disease Control and Prevention. (2010b). United States cancer statistics: 1999-2007 incidence and mortality web-based report. *Cancer Statistics Working Group.*

Centers for Disease Control and Prevention. (2011). National, state, and local area vaccination coverage among adolescence aged 13 through 17 years – United States, 2010. *Mortality and Morbidity Weekly Report, 60*(33), 1117-1123.

Centers for Disease Control and Prevention, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention. (March, 22, 2012). *What is HPV?* Retrieved from http://www.cdc.gov/hpv/WhatIsHPV.html.

Centers for Disease Control and Prevention. (March, 18, 2013). Genital HPV infection – Fact sheet. Retrieved from http://www.cdc.gov/std/hpv/stdfact-hpv.html.

Charo, R. A. (2007). Politics, parents, and prophylaxis – Mandating HPV vaccination in the United States. *The New England Journal of Medicine 356*(19), 1905-1908.

Colin, T. J. (Ed.). (2007). HPV Vaccine [Special issue]. *CQ Researcher, 17*(18), 409-432.

Davis, K., Dickman, E. D., Ferris, D., & Dias, J. K. (2004). Human papillomavirus vaccine acceptability among parents of 10- to 15-year-old adolescents. *Journal of Lower Genital Tract Disease, 8*(3), 188-194.

Gibbs, N. (2006, June 21). Defusing the war over the "promiscuity" vaccine. *Time Magazine.* Retrieved from http://www.time.com.

Haber, G., Malow, R. M., & Zimet, G. D. (2007). The HPV vaccine mandate controversy. *Journal of Pediatric Adolescent Gynecology, 20*, 325-331.

Hansen, W. B., Hahn, G. L., & Wolkenstein, B. H. (1990). Perceived personal immunity: Beliefs about susceptibility to AIDS. *The Journal of Sex Research, 27*(4), 622-628.

Kaestle, C. E., Halpern, C. T., Miller, W. C., & Ford, C. A. (2005). Young age at first sexual intercourse and sexually transmitted infections in adolescents and young adults. *American Journal of Epidemiology, 161*(8), 774-780.

Kahn, J. A., Zimet, G. D., Bernstein, D. I., Riedesel, J. M., Lan, D., Huang, B., & Rosenthal, S. L. (2005). Pediatricians' intention to administer human papillomavirus vaccine: The role of practice characteristics, knowledge, and attitudes. *Journal of Adolescent Health, 37,* 502-510.

Kahn, J. A., Cooper, H. P., Vadaparampil, S. T., Pence, B. C., Weinberg, A. D., LoCoco, S. J., & Rosenthal, S. L. (2009). Human papillomavirus vaccine recommendations and agreement with mandated human papillomavirus vaccination for 11-to-12-year-old girls: A Statewide survey of Texas physicians. *Cancer Epidemiology, Biomarkers, and Prevention, 18*(8), 2325-2332.

Kreimer, A. R., Rodriguez, A. C., Hildesheim, A., Herrero, R., Porras, A., Schiffman, M., . . .Wacholder, A. (2001). Proof-of-principle evaluation of the efficacy of fewer than three doses of a bivalent HPV 16/18 vaccine. *Journal of the National Cancer Institute, 103*(19), 1444-1451.

Liddon, N. C., Leichliter, J. A., & Markowitz, L. E. (2012). Human papillomavirus vaccine and sexual behavior among adolescent and young women. *American Journal of Preventive Medicine, 42*, 44-52.

Mortensen, G. L. (2010). Drivers and barriers to acceptance of human-papillomavirus vaccination among young women: A qualitative and quantitative study. *BMC Public Health, 10*(68), 1-14.

National Cervical Cancer Coalition. (2012). *Cervical Cancer.* Retrieved on April 26, 2012 from: http://www.nccc-online.org/index.php/cervicalcancer.

Nunnaly, J. (1978). *Psychometric theory.* New York: McGraw-Hill.

O'Rourke, M. (2007, September 27). Cancer sluts: Does the HPV vaccine "promote" promiscuity? *Slate Magazine.* Retrieved from http://www.slate.com.

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

Peterman, T. A., Lin, L. S., Newman, D. R., Lamb, M. L., Bolan, G., Zenilman, J. . . Malotte, C. K. (2000). Does measured behavior reflect STD risk? *Sexually Transmitted Diseases, 27*(8), 446-451.

Root, J. (2011, August 15). Under scrutiny, Perry walks back HPV decision. *The Texas Tribune.* Retrieved from http://www.texastribune.org

U.S. Department of Health and Human Services, Offices of Disease Prevention and Health Promotion. (2012a). *Healthy People 2020.* Retrieved from http://www.healthy people.gov/2020/topicsobjectives2020/objectivelist.aspx?topicId=23

U.S. Department of Health and Human Services, National Cancer Institute. (2012b). *HPV and cancer.* Retrieved from

http://cancer.gov/cancertopics/factsheet/Risk/HPVfs3_20..pdf

Schuler, C. L., Reiter, P. L., Smith, J. S., & Brewer, N. T. (2011). Human papillomavirus vaccine and bahavioural disinhibition. *Sexually Transmitted Infections, 87*(4), 349-353.

Taylor, L. D., Hariri, S., Sternberg, M., Dunne, E. F., & Markowitz, L. E. (2011). Human papillomavirus vaccine coverage in the United States, National Health and Nutrition Examination Survey, 2007-2008. *Preventive Medicine, 52,* 398-400.

Vamos, C. A., McDermott, R. J., & Daley, E. M. (2008). The HPV vaccine: Framing the arguments for and against mandatory vaccination of all middle school girls. *Journal of School Health, 78*(6), 302-309.

Waller, J., Marlow, L. A., & Wardle, J. (2006). Mothers' attitudes towards preventing cervical cancer through human papillomavirus vaccination: A qualitative study. *Cancer Epidemiology, Biomarkers, and Prevention, 15*(7), 1257-1261.

Zimet, G. D., Perkins, S. M., Sturm, L. A., Bair, R. M., Juliar, B. E., & Mays, R. M. (2005). Predictors of STI vaccine acceptability among parents and their adolescent children. *Journal of Adolescent Health, 37*, 179-186.