Journal of Nursing & Interprofessional Leadership in Quality & Safety

Volume 1
Issue 1 *Fall*

Article 4

2016

An Assessment of the Human Papillomavirus Immunization Knowledge, Practices, and Prevention Among a Cohort of Urban College Students

Nancy H. Busen PhD, FNP-BC, APRN
The University of Texas Health Science Center at Houston, School of Nursing, nancy.h.busen@uth.tmc.edu

Robert G. Hanks PhD, RN, FNP, APRN
The University of Texas Health Science Center at Houston, School of Nursing, robert.g.hanks@uth.tmc.edu

Eileen R. Giardino PhD, RN, APRN, FNP
The University of Texas Health Science Center at Houston, School of Nursing, eileen.r.giardino@uth.tmc.edu

Stanley Cron MSPH
The University of Texas Health Science Center at Houston, School of Nursing, stanley.cron@uth.tmc.edu

An Assessment of the Human Papillomavirus Immunization Knowledge, Practices, and Prevention Among a Cohort of Urban College Students

Cover Page Footnote
This research was conducted with a UTHealth PARTNERS grant award

Introduction

Approximately 79 million Americans are currently infected with human papillomavirus (HPV), and 14 million more infections occur every year (Satterwhite et al., 2013). Young adults 15-24 years of age account for about one-half of new HPV infections (Markowitz et al., 2014). The advent of HPV vaccines and resulting discourse in medical and public realms focused attention on this particular type of infection (Hudson, Rondinelli, Glenn, Peciado, & Chao, In Press). Vaccinations are in the forefront of patient-provider encounters due to current recommendations for vaccinating male and female patients. However, a paucity of literature restricts acquisition of knowledge, particularly in the college age patient.

Background and Significance

Cervical cancer, caused by oncogenic HPV genotypes, is the fourth leading cause of cancer among women worldwide (World Health Organization, 2015). In addition, HPV is the most common sexually transmitted diseases in the United States (Satterwhite et al., 2013). Although HPV vaccines are a strong weapon against genital cancers, immunization rates among adolescents and young adults remain relatively low (Markowitz et al., 2014; Reagan-Steiner et al., 2015). Results from a 2014 national survey of adolescent vaccination rates showed that HPV vaccine coverage rates were 60% for females and 40% for males; however, not all adolescents took the recommended three dose series conferring immunity (Centers for Disease Control and Prevention [CDC], 2014a; Reagan-Steiner et al., 2015). Falling short of the Healthy People 2020 goals for 80% immunizations, some 40% of females and 22% of males received all three of the recommended doses (US Department of Health and Human Services, 2014).

Of the more than 150 documented genotypes of HPV, approximately 40 affect the genital tract (Bernard et al., 2010). Using data from the HPV in Men (HIM) study, the prevalence of HPV in males 18 to 70 years was estimated to be over 50%, with 6% caused specifically by HPV 16 (Giuliano et al., 2011). Persistent infections with HPV genotypes 16 and 18 cause approximately 70% of cervical cancers in females, and HPV 16 is also attributed to the majority of cases of anogenital, and some oropharyngeal, cancers in both sexes (International Agency for Research on Cancer [IARC], 2012). In a six-year Canadian study of 222 couples aged 18 to 24, evidence suggests that males, whose female partner had genital or oral HPV 16, were at risk for acquiring oral HPV 16 infections themselves (American Association of Cancer Research, 2014). Genital warts, which are highly infectious but not pre-cancerous, are caused primarily by HPV genotypes 6 and 11, and some 500,000 cases occur among sexually active men and women annually (CDC, 2011b; CDC, 2012).

Burden of HPV Infection

The economic burden of direct medical costs associated with HPV-related cancers in the U.S. is estimated at $1.4 billion per year (Chesson et al., 2012). Some $300 million per year is spent on genital warts and $200 million per year on recurrent respiratory papillomatosis (RRP), a rare disease caused by HPV 6 and 11 that is characterized by the growth of wart-like tumors in the respiratory tract (Lacey, Lowndes, & Shah, 2006; National Institute on Deafness and Other Communication Disorders, 2010).

Despite a number of treatment strategies, including surgical excision, the underlying cause of HPV is incurable as no antiviral therapy exists (CDC, 2012). In addition to medical costs, having a HPV infection negatively affects emotional, social, and sexual functioning. Many young adults report a decline in self-esteem, a negative body image, and the fear of disclosure to sexual partners (Fleurence, Dixon, Milianova, & Beusterien, 2007).

HPV Vaccination

Because of limited access to vaccination records after high school, there is little actual information on HPV vaccination rates for young adults (Dempsey, Cohn, Dalton, & Ruffin, 2011). One estimate is that sexually transmitted disease (STD) rates are the highest between the ages of 20 to 24 years (CDC, 2014b). Although initial HPV infection may occur during adolescence or young adulthood, HPV-related cancers usually occur later in life; however, genital warts may occur as quickly as 0-5 months after exposure to HPV genotypes 6 and 11 (Winer et al., 2005).

A study in Australia of some 7000 patients over a 6 year time period reported the incidence of genital warts declined from 18.6% to 1.9% in females and from 22.9% to 2.9% in young males who were vaccinated against HPV (Read et al., 2011). Although appropriate vaccination for HPV effectively prevents cervical cancer and genital cancers, vaccinating both males and females has the potential to produce "herd" immunity by radically decreasing the rate of HPV transmission (Markowitz et al., 2014). To decrease the transmission of HPV through oral and genital contact, the quadrivalent HPV vaccine (4vHPV) was recommended for young women in 2006 (Markowitz et al., 2007) and for young males in 2011 (CDC, 2011b). A bivalent HPV vaccine for females continues to be available, but the vaccine covers just two strains of HPV (16 and 18). The 4v HPV vaccine has a high rate of efficacy in both males and females, with estimated levels of immunity at 90% for females (Markowitz et al., 2007) and 89% for males (CDC, 2011b). Markowitz et al. (2016) found that 4vHPV prevalence (covered by the 4vHPV vaccine) decreased 64% among vaccinated females age 14 to 19 and 34% for those 20 to 24 years of age.

In 2015, the Advisory Committee on Immunization Practices (ACIP) recommended the 9-valent HPV vaccine (9vHPV) as one of the vaccines available for routine immunization in males and females because it contains an additional five strains of HPV virus-like particles (VLPs) that cover anal cancers in males (Merck, 2015) and additional precancerous or dysplastic conditions of the genital tract (Petrosky et al., 2015). Efficacy rates for the 9v HPV vaccine are estimated at 96.5% (Petrosky et al., 2015).

The Centers for Disease Control and Prevention (2016) recommends that males and females 11-12 years of age should receive either the 4vHPV vaccine or the 9-vHPV vaccine to prevent genital warts and genital and oral cancers. While the recommended age for initiating the vaccine series for males and females is between 11-12 years, the vaccine can be administered as early as age 9 years, and catch-up vaccination is recommended for up to the age of 26 years for females and 21 years for males. According to the CDC (2014a), because HPV antibody formation is strongest among school-aged children, the goal in vaccinating young boys and girls is to promote antibody formation prior to exposure to the HPV virus during sexual activity. If not vaccinated with the 4vHPV or the 9-vHPV at the recommended age, sexually active young adults can receive some benefit from HPV vaccines. This is because exposure to all HPV type vaccines is unlikely, so the vaccine protects for types to which the young adult has not been exposed (CDC, 2011a).

Although the HPV vaccines have proven to be highly effective in adolescents and young adults age 16-26 years (Dahlstrom et al., 2012; Dempsey, Cohn, Dalton & Ruffin, 2011), there is limited data on the levels of immunization among college students, especially among young males (Katz, Krieger, & Roberto, 2011). Until recently, college students were not vaccinated as children against HPV because the vaccines were not available, accessible, or promoted by health professionals (McRee, Gilkey, & Dempsey, 2014) and parents for the most part did not want them (Gilkey, McRee, & Brewer, 2013). Although the current college population at urban campuses may have been eligible for the HPV vaccine as grade school or high school students, parents were required to grant permission, and parents may have declined administration of the vaccine for a variety of reasons. However, students 18 years and

older may give their own consent for the HPV vaccine and may be more receptive to receiving both HPV prevention education and HPV immunization.

Racial Disparities in HPV

Published data shows that racial disparities also exist. Prevalence rates for non-Hispanic Black females aged 18 to 25 years is at 35%, versus 25% for non-Hispanic White peers (Harling, Subramanian, Barnighausen, & Kawachi, 2013: Manhart et al., 2006). In support of this, vaccination uptake data from the CDC in 2013-2014 showed that HPV vaccinations for adolescent females were lowest for non-Hispanic Blacks, as compared to non-Hispanic whites, in initial immunization and completion of the 3-dose series (CDC, 2013; Reagan et al., 2015). In adult women with cervical cancer, racial and ethnic disparities are pervasive with women of color disproportionately represented in both incidence and mortality (Ford, 2006; Harling et al., 2013).

Purpose and Research Questions

The purpose of this study was to describe the immunization knowledge, practices and prevention of HPV of a young adult population enrolled in an urban university. The urban college population selected provided a sample rich in racial and ethnic diversity. As such, data outcomes serve to inform the field of HPV immunization with meaningful data on various racial, ethnic, and sexual preference groups. Data and findings from this study will add to the limited knowledge about HPV immunization coverage in young adult men and women, especially among males of ethnic minorities. The project initiative is based on the recommendation of several studies that suggested that more information is needed on HPV immunization in young adults and that catch-up vaccination among males and females is important to decreasing the rate of HPV transmission (CDC, 2011b; CDC, 2016; Ford, 2011).

The research questions that guided the study were as follows:

1. Is there a relationship between HPV knowledge and HPV immunization?
2. Is there a relationship between HPV prevention behaviors and HPV immunization?
3. Is there a difference between the HPV vaccination rates in a cohort of urban college students compared to the national HPV vaccination rates in males and females?
4. Is there a difference between male and female students in HPV knowledge?
5. Is there a difference between male and female students in HPV prevention behaviors?
6. Is there a difference in HPV vaccination levels between young adults with health insurance and those without health insurance?

Methods

Setting and Sample

The setting for this descriptive study was a large urban university located in the southwest that is rich in ethnic and racial diversity. This type of setting has provided samples in other studies that have been reported as underserved and disproportionately affected by genital warts and HPV-related cancers later in life (Ford, 2011; Gerend & Magloire, 2008; Liddon, Leichliter, & Markowitz, 2012). This study sample consisted of adolescents and young adults between the ages of 18 to 26 years who were enrolled in the university, could read English, and agreed to participate. A sample size of 500 was targeted with estimated power at 80% to detect a small effect size of d = .344 as significant. The study was approved by the university's institutional review board (IRB).

Data Collection

Data were collected using an investigator-designed survey instrument developed at an 8th grade reading level. The items were predominately true or false. On four items, students choose among four or five levels of response options. The instrument consisted of questions eliciting demographic and personal information, 17 items on HPV knowledge, and 10 items on HPV prevention practices for males or 11 items for females (see Appendix A). Item content was based on current research findings on HPV and vaccination for immunization. Four experts in the area of adolescent and young adult health reviewed the items for content relevancy and revised the items accordingly. A statistician was consulted to ensure suitability for statistical analysis.

Student participation was voluntary and survey responses were anonymous. A recruitment poster was placed in a large area where students gathered between classes. A written invitation to participate was given to students, and investigators were available to answer questions regarding the study. Students could decline to participate with no penalty. Informed consent was obtained for study participants. Over a two week period, three investigators recruited participants until 500 surveys had been completed. Students completed the survey that had no student identifying information and placed it in a locked box separate from the written consents. A gift card was given to thank students for their participation.

A printed version of the survey instrument was developed for scanning data directly into an electronic database for statistical analysis. Data were considered as aggregate for analysis and did not reflect any individual's response. After data was entered into the system for analysis, a back-up set of data was stored, and the paper surveys were shredded.

Analysis

Demographic and personal sexual history data were coded, and aggregate data were reported as frequencies and percentages. Descriptive statistics were calculated for each survey item response, and HPV knowledge and HPV prevention scores obtained. Continuous variables were evaluated for approximation to normality. A *t*-test for independent samples was used to compare HPV knowledge and HPV prevention scores between groups. Chi-square analysis was used to compare the HPV vaccination rate in the study sample with national rates of HPV vaccination and the percentage of the sample vaccinated against HPV in students with and without health insurance.

Results

Of the 500 surveys collected, data from 479 completed surveys were analyzed for a 95.8% return rate. Not all data equaled 100% because of missing responses to various items. Sample demographic characteristics are summarized in Table 1. The students age range was 18 to 26 years with a mean age of 20.02 years for males (n=174) and 20.30 years for females (n=295). Female respondents outnumbered the males at 58.5% and 34.5% respectively. The sample respondents were mainly single (88%), more than half were college freshman and sophomores, and approximately 90% were non-smokers. Most students were employed part time (49%) or not at all (37%), and about half (49.2%) had health insurance.

The sample was largely non-White Hispanic or Latino (53.2%), followed by Black or African American (18.3%), Asian (0.9%), White non-Hispanic (6.5%), and of two or more races (5.0%). Sexual preference was mostly heterosexual with one to three lifetime partners, and the majority of students reported condom use as "always" or "75% of the time". The percentage of males with 4 or more sexual lifetime partners (29.59%) was significantly higher than for females (17.38%; p = 0.0071).

Table 1. Characteristics of the College Sample		
Mean Age Male Participants	20.02 years	
Mean Age Female Participants	20.30 years	
	n	%
Gender: Males	174	34.5
Gender: Females	295	58.5
Marital Status		
Married	18	3.8
Single	444	88.1
Separated	1	0.2
Divorced	3	0.6
Living with a partner but single	13	2.6
Level of Education		
Freshman	191	37.9
Sophomore	122	24.2
Junior	106	21.0
Senior	53	10.5
Graduate Student	3	0.6
Employment		
Full time (40 hours/week or more)	49	9.7
Part time (less than 40 hours/week)	245	48.6
None	184	36.5
Health Insurance		
No	230	45.6
Yes	248	49.2
Race/Ethnicity		
White-non Hispanic or Latino	33	6.5
Non-White-Hispanic or Latino	268	53.2
Black/African American	93	18.3
American Indian/Alaskan Native	3	0.6
Asian	50	9.9
Two or more races	25	5.0
Unknown	8	1.6

Results of sexual history and prevention practices are shown in Table 2. Male participants (13.29%) were significantly more likely than females (6.87%) to be diagnosed with genital warts (p=0.0211). Females participants were more likely than the males to have had at least one dose of the HPV vaccine (p <0.0001). Both genders were unsure if they had had three doses of the HPV vaccine. HPV vaccination rates among Hispanic and Black females in the sample were significantly higher than national rates (p < .0001), but insurance coverage did not correlate with vaccination rates.

Table 2. Sexual History and Prevention Practices				
	Male *n*	Male Percent	Female *n*	Female Percent
Sexual Preference:				
Heterosexual	151	87.79	254	86.10
Homosexual	16	9.30	20	6.78
Bisexual	5	2.91	18	6.10
None preferred	0	0	3	1.02
Number of Lifetime Sexual Partners				
0 Partners	2	1.18	15	5.94
1 Partner	75	44.38	144	50.35
2 Partners	27	15.98	41	14.34
3 Partners	5	8.88	33	11.54
4 or more Partners	50	29.59	51	17.38
Condom Use with Sexual Activity				
Always	89	52.05	127	47.04
About 75% of the time	30	17.54	51	18.89
About 50% of the time	16	9.36	31	11.48
About 25% of the time	11	6.43	21	7.78
Never use condoms	25	14.62	40	14.81
Smoking History				
None	150	86.21	271	92.81
Less than 20 cigarettes/day	22	12.64	20	6.85
More than 20 cigarettes/day	2	1.15	1	0.34
Have you had at least one dose of the HPV vaccine?				
No	105	61.76	119	41.75
Yes	65	38.24	166	58.25
Have you had three doses of the HPV vaccine?				
No	76	44.19	124	42.32
Yes	24	13.95	93	31.74
Uncertain	72	41.86	76	25.94
Female Participants Only: Had a Pap test in the past 2 years				
No	-	-	185	62.7
Yes	-	-	110	21.8
I was vaccinated against HPV in:				
Grade School	8	4.73	13	4.69
High School	32	18.93	101	36.46
College	10	5.92	25	9.03
I don’t know when I was vaccinated	42	24.85	39	14.08
I don’t know if I was vaccinated	77	45.56	99	35.74

Table 2. Sexual History and Prevention Practices				
	Male *n*	Male Percent	Female *n*	Female Percent
Were you diagnosed with genital warts in the past?				
No	23	13.29	20	6.87
Yes	150	86.71	271	93.13
Where would you go first to find information about HPV?				
Health care provider	94	56.97	191	67.73
Family Member	10	6.06	12	4.26
Internet	57	34.55	74	26.24
Friends	4	2.42	5	1.77
I would get the HPV vaccine if it were available to me				
No	150	87.21	251	88.38
Yes	22	12.79	33	11.62
I would like more information on HPV				
No	111	65.29	193	67.25
Yes	59	34.71	94	32.75

Knowledge and Prevention Scores

Overall, males had significantly higher mean prevention scores (84.05; $p < .0001$) than females (71.20). In females, the mean HPV prevention score was statistically significantly higher if vaccinated (79.60; $p<0.0001$), with the highest prevention mean occurring when all 3 HPV vaccinations had been received (83.89). The next highest mean score was in relation to uncertain if all three doses received (69.47), and the lowest mean was for females not receiving all three doses of HPV vaccine (63.11).

Differences between responses by gender were not significant, except for specific knowledge items. Female participants were more likely to answer correctly the question regarding the possibility of HPV transmission by kissing an infected person (70.98%; $p<0.0001$), while male participants were more likely to answer the "some types of HPV can cause throat cancer" question correctly (64.53%; $p=0.0093$). Female participants were more likely to correctly answer "you must complete the 3-dose series for HPV vaccination" question (87.02%; $p=0.0064$).

Discussion

It is notable that the male participant vaccination rate was not significantly different than published rates; however, this may be a reflection of the timing of approval for HPV vaccines. In the sample, male participants were more likely than females to be diagnosed for genital warts, possibly because genital warts are more detectable on males than on females because of the female anatomy. The low percentage of females that had a Pap smear is consistent with new guidelines put forth by American College of Obstetricians and Gynecologists (2016) on age to initiate Pap smear screening.

Insurance coverage for females in the sample was not a factor in completing the vaccination series. This suggests that insurance coverage is not a barrier to vaccination in this population. A high percentage of the male participants (41.86%) were uncertain if they had completed the vaccine series, with only 13.95% stated that they had. A lower percentage of female participants (25.94%) were uncertain of completing 3 doses of vaccine. This suggests that clinicians should emphasize the importance of completing the 3 dose series to confirm immunity, even as "catch-up" among older adolescents and young adults of both genders. An example of the need for correct and adequate

education is that the sample participants indicated that they would not be willing to obtain the vaccination if available to them (87.21% of males and 88.38% of females).

Much of the data reported in current literature on young adults and HPV were collected by means of on-line or mailed surveys. Use of these media often results in low response return rates. For example, Dillard and Spear (2010) in a sample of female college students had a response rate of 22%. In this study, because college health care clinic personnel directly distributed the survey instrument to students until the target sample size was reached, an extremely high return rate (95.8%) of completed questionnaires was achieved. Furthermore, recommendations for vaccination have been relatively recent (2006 for females and 2011 for males). Thus, there was opportunity to provide the students with relevant information. Health care personnel were available to answer questions and share information about HPV prevention and clinic services after students completed the survey. Various authors have noted that health care providers' dispersal of information and recommendations make young adults more likely to accept the HPV vaccine (Dillard & Spear, 2010; Jones & Cook, 2008).

Accurate and reliable data on young adults' knowledge and preventive practices respective to HPV are necessary to determine the most appropriate approach to increasing HPV vaccination levels among young males and females to prevent spread of this disease. The study can also add to existing information on HPV vaccination among young adults, especially in relation to gender and ethnic considerations as the sample was largely female (58%) and of Non-White-Hispanic or Latino background (53%). Because some levels of significance were found in relation to the male responses, this information also adds to the existing knowledge base of male preferences and practices.

Recommendations for Practice

The number of respondents who did not complete the HPV 3-dose series, or did not know if they had, illustrates the need for health care providers to stress the importance of completing the three dose series. The emphasis needs to be on confirmation of immunity and barriers to returning to clinic for the second and third doses eliminated. In addition, vaccination rates need to be increased among adolescents as per standard recommendations. One way to do so may be to explain the importance of HPV vaccination during annual well child examinations when the patient is covered by a parent's insurance.

Education about HPV disease, prevention practices, and treatment is an essential part of health care instruction for adolescents and young adults. Discussions can occur when young patients present for any acute illness. Clinicians should inform these patients and families about the cost of the vaccination series as well as insurance coverage or resources available to cover the costs. At the college health level, various health promotion initiatives can be promoted on the college campus that provide the opportunity for clinicians to reinforce the importance of prevention of sexually transmitted diseases and, specifically, HPV prevention practices and vaccine availability.

The finding that male participants were more likely than female participants to have been diagnosed with genital warts may indicate that females did not have HPV or were not as readily diagnosed with HPV as their male counterparts. To aid in diagnosis, healthcare providers need to educate female patients about self-examination for HPV lesions. Because self-identification of HPV may be more difficult for the female than in the male due to anatomy, healthcare provider should address self-identification measures as well as prevention methods for HPV.

Conclusion

This study provides essential data in regard to college age students' knowledge about HPV and preventive sexual practices that help prevent HPV infection or transmission. Despite differences in knowledge levels between genders, a significant number of participants were either not vaccinated or

did not complete the 3-dose series. This data provides direction for healthcare providers to improve student's knowledge on causes and preventive strategies, promote the completion of vaccination series, and focus on educational efforts to prevent the transmission of HPV.

References

American Association for Cancer Research (2014). Oral cancer-causing HPV may spread through oral and genital routes. Retrieved from www.aacr.org/Newsroom/Pages/News-Release-Detail.aspx?ItemID=624#.VGOIRVq.

American College of Obstetricians and Gynecologists (2016). Practice bulletin summary. *Obstetrics & Gynecology, 127*(1), 185-187.

Bernard, H., Burk, R., Chen, Z., van Dooslaer, K., zur Hausen, H., & de Villiers, E. (2010). Classifications of papillomaviruses (PVs) based on 189 PV types and proposal of taxonomic amendments. *Virology*, *401*(1), 70-79.

Centers for Disease Control and Prevention (2011a). Recommendations on the use of quadrivalent human papillomavirus vaccine in males. Advisory Committee on Immunization Practices (ACIP), 2011. *Morbidity and Mortality Weekly Report*, *60*(50), 1705-1708.

Centers for Disease Control and Prevention (2011b). FDA licensure of quadrivalent human papillomavirus vaccine (HPV4, Gardasil) for use in males and guidance from the Advisory Committee on Immunization Practices (ACIP), 2010. *Morbidity and Mortality Weekly Report, 59*(20), 630-632.

Centers for Disease Control and Prevention (2012). STDs in adolescents and young adults. Retrieved from http://www.cdc.gov/std/stats11/adol.htm

Centers for Disease Control and Prevention. (2013). CDC health disparities and inequalities report - United States 2013. *Morbidity and Mortality Weekly Report, 62*(3), Supplement.

Center for Disease Control and Prevention. (2014a). Human Papillomavirus vaccination coverage among adolescents, 2007–2013, and postlicensure vaccine safety monitoring, 2006–2014 — United States. *Morbidity and Mortality Weekly Report, 63*(29), 620-624.

Center for Disease Control and Prevention. (2014b). Sexually transmitted disease surveillance: STD in adolescents and young adults. Retrieved from www.cdc.gov/std/stats14/adol.htm

Center for Disease Control and Prevention. (2016). Birth-18 years and "catch-up" immunization schedules: United States, 2016. Retrieved from www.CDC.gov/Vaccines/Schedules

Chesson, H., Ekwueme, D., Saraiya, M, Watson, M., Lowry, D., & Markowitz L. (2012). Estimates of the annual direct medical costs of the prevention and treatment of disease associated with human papillomavirus in the United States. *Vaccine, 30*(42), 6016-6019.

Dahlstrom, L., Sundstrom, K., Young, C, Lundholm, C., Sparén, P., & Tran, T. (2012). Awareness and knowledge of human papillomavirus in the Swedish adult population. *Journal of Adolescent Health, 50*(2), 204-206.

Dempsey, A., Cohn, L., Dalton, V., & Ruffin, M. (2011). Worsening disparities in HPV vaccine utilization among 19-26 year old women. *Vaccine, 29*(3), 528-534.

Dillard, J., & Spear, M. (2010). Knowledge of human papillomavirus and perceived barriers to vaccination in a sample of US female college students. *Journal of American College Health, 59*(3), 186-190.

Fleurence R., Dixon J., Milianova J., & Beusterien K. (2007). Review of the economic and quality-of-life burden of cervical human papillomavirus disease. *American Journal of Obstetrics and Gynecology, 196*(3), 206-212.

Ford J. (2011). Racial and ethnic disparities in human papillomavirus awareness and vaccination among young adult women. *Public Health Nursing, 28*(6), 485-493.

Gerend M., & Magloire Z. (2008). Awareness, knowledge, and beliefs about human papillomavirus in a racially diverse sample of young adults. *Journal of Adolescent Health, 42*(3), 237-242.

Gilkey, M., McRee, A., & Brewer, N. (2013). Forgone vaccination during childhood and adolescence: Findings of a statewide survey of parents. *Preventive Medicine, 56*(3), 202-306.

Giuliano A., Lee J., Fulp W., Villa L., Lazcano, E., Papenfuss, M., . . . Smith, D. (2011). Incidence and clearance of human papillomavirus infection in men (HIM): A cohort study. *Lancet, 377*(9769), 932-940.

Harling G., Subramanian S., Barnighausen T., & Kawachi I. (2013). Socioeconomic disparities in sexually transmitted infections among young adults in the United States: Examining the interaction between income and race/ethnicity. *Sexually Transmitted Disease. 40*(7), 575-581.

Hudson, S., Rondinelli, J., Glenn, B., Preciado, M., & Chao, C. (In Press). Human papillomavirus vaccine series completion: Qualitative information from providers within an integrated healthcare organization. Retrieved from http://dx.doi.org/10.1016/j.vaccine.2016.02.066

International Agency for Research on Cancer. Working Group on the Evaluation of Carcinogenic Risks to Humans (2012). Biologic agents. Volume 100B: A review of human carcinogens. *IARC Monographs Evaluation of Carcinogens Risks, 100B,* 1-441.

Jones, M., & Cook, R. (2008). Intent to receive an HPV vaccine among men and women and implications for vaccine administration. *Journal of American College Health, 57*(1), 23-31.

Katz, M., Krieger, J., & Roberto, A. (2011). Human papillomavirus (HPV): College male's knowledge, perceived risk, sources of information, vaccine barriers and communication. *Journal of Men's Health, 8*(3), 175-184.

Lacey, C., Lowndes, C., & Shah, K., (2006). Burden and management of non-cancerous HPV-related conditions: HPV-6/11. *Vaccine, 24*(Supplement 3) 35-41.

Liddon, N., Leichliter, J., & Markowitz, L. (2012). Human papillomavirus vaccine and sexual behavior among adolescent and young women. *American Journal of Preventive Medicine, 42*(1), 44-52.

Markowitz, L., Dunne, E., Saraiya, M., Lawson, H., Chesson, H., & Unger, E. (2007). Quadrivalent human papillomavirus vaccine. Recommendations of the Advisory Committee on Immunization Practices (ACIP). *Morbidity and Mortality Weekly Report, 56*(RR-2):1-24.

Markowitz, L., Dunn, E., Saraiya, M., Chesson, H., Curtis, C.R., Gee, J., . . . Unger, E. (2014). Human papillomavirus vaccine: Recommendations of the Advisory Committee on Immunization Practices (ACIP). *Morbidity and Mortality Weekly Report, 63*(RR-5), 1-30.

Markowitz, L., Liu, G., Hariri, S., Steinau, M., Dunne, E., & Unger E. (2016). Prevalence of HPV after introduction of the vaccination program in the United States. *Pediatrics, 137*(3), 1-9.

Manhart, L., Holmes, K., Koutsky, L., Wood, T., Kenney, D., Feng, Q., & Kiviat, N. (2006). Human papillomavirus infection among sexually active young women in the United States: Implications for developing a vaccination strategy. *Sexually Transmitted Disease, 33*(8), 502-508.

McRee, A., Gilkey, M., & Dempsey, A. (2014). HPV vaccine hesitancy: Findings from a statewide survey of health-care providers. *Journal of Pediatric Health Care, 38*(6), 541-549.

Merck (2015). Why 9 types? Broader disease coverage due to HPV types. Retrieved from https://www.merckvaccines.com/Products/Gardasil9

National Institute on Deafness and Other Communication Disorders (2011). Recurrent respiratory papillomatosis or laryngeal papillomatosis. Retrieved from: https://www.nidcd.nih.gov/health/recurrent-respiratory-papillomatosis

Petrosky, E., Bocchini, J., Hariri, S., Chesson, H., Curtis, C., Saraiya, M., . . . Markowitz, L. (2015). Use of 9-valent human papillomavirus (HPV) vaccine: Updated HPV vaccination recommendations of the Advisory Committee on Immunization Practices. *Morbidity and Mortality Weekly Report, 64*(11), 300-304.

Read, T., Hocking, J., Chen, M., Donovan, B., Brandshaw, C., & Fairley, C. (2011). The near disappearance of genital warts in young women 4 years after commencing a national human papillomavirus (HPV) vaccination programme. *Sexually Transmitted Infection, 87*(7), 544-547.

Reagan-Steiner, S., Yankey, D., Jeyarajah, J., Elam-Evans, L., Singleton, J., Curtis, R., . . . Stokley, S. (2015). National, regional, state, and selected local area vaccination coverage among adolescents aged 13-17 years-United States 2014. *Morbidity and Mortality Weekly Report, 64*(29), 784-792.

Satterwhite, C., Torrone, E., Meites, E., Dunne, E., Mahajan, R., Ocfemia, M. . . . Weinstock, H. (2013). Sexually transmitted infections among US women and men: Prevalence and incidence estimates, 2008. *Sexually Transmitted Disease, 40*(3), 187-193.

US Department of Health and Human Services. *Healthy people 2020. Leading health indicators*. Retrieved from https://www.healthypeople.gov/

Winer, R., Kiviat N., Hughes J., Adam, D., Lee, S., Kuypers, J. & Koutsky, L. (2005). Development and duration of human papillomavirus lesions after initial infection. *Journal of Infectious Disease, 191*(5), 731-738.

World Health Organization (2015). *Human papillomavirus (HPV) and cervical cancer*. Retrieved from: http://www.who.int/mediacentre/factsheets/fs380/en/

Appendix A. HPV Knowledge Among Male and Female College Students				
Item	Correct Answer Male *n*	Correct Answer Male Percent	Correct Answer Female *n*	Correct Answer Female Percent
HPV is a virus	162	94.74	273	93.49
HPV can cause genital warts	136	78.61	222	76.82
Some types of HPV can cause cervical cancer in women	149	85.63	259	89.62
The HPV vaccination will protect me against HPV	125	72.25	198	68.99
HPV is the most common sexually transmitted disease	108	62.43	174	60.42
I can get HPV by kissing an infected person	91	52.60	203	70.98
The Pap test will detect HPV in females	128	74.42	211	73.52
There is a blood test that detects HPV in males	26	15.12	56	19.58
Some types of HPV can cause throat cancer	111	64.53	149	52.10
Some types of HPV can cause cancer in men	136	78.61	210	72.66
A person can have HPV and not know it	162	93.10	275	94.50
HPV vaccines are recommended for both males and females	154	90.06	244	85.92
People infected with genital warts will get cancer	122	71.35	226	79.02
A person must complete the HPV immunization 3-dose series to be protected	132	77.19	248	87.02
People can be vaccinated against HPV up to the age of 26 years	123	71.10	208	73.24
Condom use prevents the transmission of HPV	137	79.65	224	78.32
There is a medicine to cure HPV	94	55.29	170	59.65