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BRIEF REPORT

Human papillomavirus risk perceptions and relationship status: a barrier to HPV vaccination?

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Abstract The purpose of this study was to assess the association between relationship status and perceived risk for human papillomavirus (HPV) among young adults. College adults, aged 18–26 years, completed an online survey from November 2016–April 2017 (n = 385). The survey assessed HPV vaccination status, perceived HPV risk, and current relationship status. Logistic regression models estimated the odds of perceived high risk for HPV, stratified by vaccination status. Among unvaccinated women, relationship status and HPV risk perception were significantly associated, with dating women more likely (OR = 5.33, 95%CI 1.16–24.50) to perceive a high risk for HPV compared to women in a committed relationship. Women in relationships were less likely to perceive themselves at high risk for HPV, even though HPV infection is prevalent among young adults. This association is not present for vaccinated women, suggesting that relationship status and risk perceptions may represent barriers to HPV vaccine uptake.

Keywords Vaccination · Risk perceptions · Prevention · Young adults

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Introduction

Human papillomavirus (HPV) is the most prevalent sexually transmitted infection in the US (Satterwhite et al. 2013) and a cause of anogenital and oropharyngeal cancers and genital warts (Viens et al. 2016; Munoz et al. 2003). In the US, approximately 30,700 HPV-related cancer cases are diagnosed annually (Viens et al. 2016). To reduce morbidity and mortality associated with HPV, three vaccines (bivalent, quadrivalent, and nonavalent) are available starting at age 9 (Petrosky et al. 2015). Routine HPV vaccination is recommended for adolescents 11–12 years of age. Yet in 2016, only 60.4% of U.S. adolescents ages 13–17 had received at least one HPV vaccine dose and only 43.4% received all doses (Walker et al. 2017).

If adolescents do not receive the vaccine at the recommended ages, they may participate in "catch-up" vaccination during ages 18–26 years: 18–26 for women, 18–21 for men, and 22–26 years for high-risk men (Petrosky et al. 2015). Young adults are considered a priority population since this is the last opportunity for cancer prevention using the vaccine. Unfortunately, rates of vaccination in the catch-up age range among young adults are still low; in 2015, only 41.6% of women and 10.1% of men reported receiving at least one HPV vaccine dose (Williams et al. 2017). Thus, it is important to examine why groups of young adults are not vaccinated.

Barriers to HPV vaccine uptake in young adulthood may vary for men and women. Previous research revealed that young adult women in relationships were less likely to be interested in and receive the HPV vaccine than single young adult women (Laz et al. 2013; Schmidt and Parsons 2014; Thompson et al. 2016). Being in a monogamous relationship was reported as the second most common barrier to vaccination for HPV vaccination among women in a community clinic (Wilson et al. 2016). To investigate the association between relationship status and HPV vaccination further, qualitative research has elicited that young adult women in relationships perceived themselves at lower risk of HPV than women who are single or dating. Specifically, women in long-term or committed relationships perceive themselves at lower risk because of the perceived protection with monogamy and few sexual partners (Thompson et al. 2017). While monogamy is considered a protective factor, the risk for HPV still exists. It is estimated that the average lifetime probability of acquiring HPV with at least one sexual partner of the opposite sex is 84.6% (range 53.6–95.0%) among women and 91.3% (range 69.5–97.7%) among men—the risk of HPV precipitously increases with additional sexual partners (Chesson et al. 2014). Previous research utilized qualitative methods to understand how relationship status is a barrier to HPV vaccination among women (Thompson et al. 2017); however, these findings should be confirmed among a larger sample with quantitative measures and allow for comparison between vaccinated and unvaccinated women.

While the association between relationship status and HPV vaccine uptake has not been observed among men (Bernat et al. 2013; Newman et al. 2013), there is also a need to understand how risk perception may relate to HPV vaccination among this catch-up group. Young adult men tend to have limited HPV and vaccination knowledge and may associate HPV as a "female disease" with little risk to men (Barnard et al. 2017; Fontenot et al. 2014; Fontenot and Morelock 2012). This risk perception and lack of perceived need for the vaccine warrants further investigation to determine if this may vary by relationship and vaccination status.

The purpose of this study was to assess the association between relationship status and perceived risk for HPV among vaccinated and unvaccinated young adults. This study builds on previous research that elicited the connection between relationship status and HPV vaccination among women. It was hypothesized that (1) women in relationships who were unvaccinated would be less likely to perceive themselves at high risk for HPV infection, and (2) an association between relationship status and risk perception among men would not be detected. Findings from this study can inform future intervention development for catch-up vaccination among young adults.

Methods

Sample

College students, 18 years and older, at a southeastern, public university were recruited to participate in an online sexual and reproductive health survey between November 2016 and April 2017. Participants were recruited through university listservs, campus events, courses, and other campus locations. All eligible participants consented to participate after reading and affirming to a statement of informed consent. The first 500 participants in the survey received a $10 gift card, and all survey respondents were eligible for a tablet raffle for participating. This study was approved by the University of South Florida Institutional Review Board.

The larger survey included 616 participants; the sample was further restricted to persons who identified as a man or woman (n = 601) and ages 18–26 (n = 558). Due to the range of topics in the survey, skip patterns were used so that only a limited subset of the sample received HPV vaccine questions. The analytic sample was further restricted to those participants who responded to HPV vaccine questions (n = 388) and had complete data for HPV risk perceptions (n = 385).

Measures

Participants completed an online survey that examined demographics, HPV vaccination status, perceived risk for HPV, and current relationship status. Demographic factors included gender and age. Current relationship status was categorized as single, dating, or in a committed relationship. HPV vaccination status was operationalized as vaccinated (at least one HPV vaccine dose) or unvaccinated. To assess whether participants accurately perceived their risk for HPV infection, participants reported whether they agreed to the statement "I feel I accurately understand my risk for getting an HPV infection," with responses ranging from strongly agree to strongly disagree. Finally, participants responded to the statement "I believe my risk for getting an HPV infection is…" Response options (very low, low, moderate, high, or very high risk) were categorized as very low/low HPV risk (43% very low, 33% low) and moderate/high/very high HPV risk (21% moderate, 3% high, 1% very high) due to lower frequencies in the extreme response options.

Data analysis

Bivariate comparisons by HPV risk perception were conducted using Chi-Square tests, Fisher Exact tests (when expected values were less than 5), and T-tests for continuous data. Logistic regression models with 95% confidence intervals were run to examine the association between relationship status and HPV risk perception. These models were stratified by gender to examine differences by men and women and stratified by vaccination status to examine differences by vaccinated and unvaccinated persons. SAS version 9.4 was used for all analyses.

Results

Sample demographics by gender

Among the participants (n = 385) in this survey, 79% were women and 21% were men (Table 1). Seventy-six percent of respondents considered themselves at very low/low risk and 24% of respondents saw themselves at moderate/high risk. Thirty-seven percent of all respondents were single, with a lower proportion of women reporting single as compared to men (36% and 40%, respectively). A quarter of respondents identified as dating, with a much lower proportion of women identifying as dating compared to men (21% and 35%, respectively). Four out of ten respondents were in a committed relationship with a much higher proportion of women reporting being in a committed relationship than men (43% and 25%, respectively). Most women had received at least one dose of the HPV vaccine (75%) with 67% of vaccinated individuals having completed three rounds of vaccination. Little more than half of men had at least one dose of the HPV vaccine (56%), with 38% of those individuals having completed three rounds of vaccinations. Most individuals strongly agreed or agreed that they accurately understood their risk for HPV infection (29% and 38%, respectively). One out of five respondents had no opinion and a small proportion disagreed or strongly disagreed that they understood their risk for HPV infection (10% and 3%, respectively). Overall, men and women felt that they accurately understood their risk for HPV infection to comparable degrees.

Assessment by HPV risk perception

HPV risk perception varied significantly by gender, with over three-quarters of women considering themselves at very low/low risk for HPV infection (78%) compared to about 70% of males (69%) (Table 2). Regarding relationship status, the greatest proportion of those who saw themselves at very low/low risk for HPV were those in committed relationships (81%), followed by single participants (75%) and dating participants (70%), though these findings were not statistically significant. Mean age was

Table 1 Demographic characteristics of college sample by gender, N = 385

	Women N (%)	Men N (%)	Total
	305 (79.2)	80 (20.8)	
Perceived risk for HPV infection			
Very low/low	237 (81.2)	55 (68.8)	292 (75.8)
Moderate/high	68 (22.3)	25 (31.3)	93 (24.2)
Relationship status			
Single	109 (35.7)	32 (40.0)	141 (36.6)
Dating	64 (21.0)	28 (35.0)	92 (23.9)
Committed relationship	132 (43.3)	20 (25.0)	152 (39.5)
Age	20.6 (2.0)	20.9 (2.2)	20.6 (2.0)
HPV vaccination			
Vaccinated (at least 1 dose)	230 (75.4)	45 (56.3)	275 (71.4)
Vaccine completion (at least 3)*	154 (67.0)	17 (37.8)	171 (62.2)
Unvaccinated	75 (24.6)	35 (43.7)	110 (28.6)
Accurately understand my risk for HPV infection			
Strongly agree	92 (30.2)	19 (23.8)	111 (28.8)
Agree	113 (37.1)	33 (41.3)	146 (37.9)
Neither	59 (19.3)	16 (20.0)	75 (19.5)
Disagree	33 (10.8)	7 (8.8)	40 (10.4)
Strongly disagree	8 (2.6)	5 (6.3)	13 (3.4)

*Percentage among vaccinated individuals

Table 2 Bivariate assessment by HPV risk perception among a college sample, N = 385

	HPV risk—very low/low N (%)	HPV risk—moderate/high N (%)
Gender*		
Men	55 (68.8)	25 (31.3)
Women	237 (77.7)	68 (22.3)
Relationship status		
Single	105 (74.5)	36 (25.5)
Dating	64 (69.6)	28 (30.4)
Committed relationship	123 (80.9)	29 (19.1)
Age	20.6 (2.0)	20.9 (2.0)
HPV vaccination*		
Vaccinated	218 (79.3)	57 (20.7)
Unvaccinated	74 (67.3)	36 (32.7)
Accurately understand my risk for HPV infection*		
Strongly agree	91 (82.0)	20 (18.0)
Agree	115 (78.8)	31 (21.2)
Neither	50 (66.7)	25 (33.3)
Disagree	27 (67.5)	13 (32.5)
Strongly disagree	9 (69.2)	4 (30.8)

*$P < 0.05$

20.6 years (SD = 2.0 years); however, there was no statistically significant difference found between the ages of the risk perception groups. A significantly higher proportion (79%) of individuals who had received the HPV vaccine saw themselves at very low/low risk of contracting HPV. This proportion was significantly higher than those who were unvaccinated (67%). Those who reported a very low/low HPV risk were significantly more likely to agree or strongly agree to accurately understanding their risk for HPV infection.

Modeling risk perception

For vaccinated women, relationship status was not significantly associated with HPV risk perception (Table 3). In contrast, unvaccinated women who were dating were more likely to perceive themselves at moderate/high risk for HPV compared to unvaccinated women in a relationship (OR = 5.33; 95% CI 1.16, 24.47). There were no statistically significant differences for single women compared to women in a relationship among the unvaccinated. No statistically significant differences were observed for men for the association between relationship status and HPV risk perception.

Discussion

HPV vaccination uptake among young adults is suboptimal in the U.S., and investigating barriers to uptake is needed. This study assessed the connection between HPV risk perception and relationship status, stratified by vaccination status and gender. We found that unvaccinated women in committed relationships were less likely to perceive themselves at risk for HPV compared to unvaccinated women who were dating. This effect was not observed among men. Additionally, this investigation found persons who were vaccinated for HPV had lower risk perceptions compared to people who were unvaccinated, which may be attributed to adjusted perceptions of risk once receiving the vaccine.

The relationship between low HPV risk perception and vaccination status has been noted before (Liddon et al. 2012; Manhart et al. 2011). However, by exploring HPV risk perception by relationship status, we can investigate the nuances of this barrier to HPV vaccination. Previous research has found that women ages 19–26 years old remain unvaccinated mainly due to being married or monogamous (Zimet et al. 2010). Moreover, research using the National Health Interview Survey examined interest in the HPV vaccine among unvaccinated women 18–26 years old and found that compared to non-married women, married women were less likely to be interested in the HPV vaccine (Schmidt and Parsons 2014). Additionally, in Australia, where the government has funded an HPV vaccine program, some young adult women also reported

Table 3 Logistic regression modeling moderate to high risk perception for HPV among women, N = 305 and men, N = 80

		N	OR (95% CI)*
Women			
Vaccinated	Single	68	1.70 (0.81, 3.59)
	Dating	52	1.22 (0.52, 2.86)
	Committed	110	Referent
Unvaccinated	Single	41	0.75 (0.23, 2.48)
	Dating	12	**5.33 (1.16, 24.47)**
	Committed	22	Referent
Men			
Vaccinated	Single	16	1.33 (0.20, 9.08)
	Dating	19	1.85 (0.30, 11.47)
	Committed	10	Referent
Unvaccinated	Single	16	1.40 (0.26, 7.58)
	Dating	9	1.87 (0.28, 12.31)
	Committed	10	Referent

*Bold values indicate statistically significant odds ratio

uncertainty about getting the vaccine because they were in a monogamous relationship (Gunasekaran et al. 2015). These findings highlight the need to educate women on HPV infection risk and HPV vaccination, including providing tailored education particularly for women in monogamous relationships.

Healthy Campus 2020 provides objectives to guide universities towards selecting health-related priorities for their population. As such, it has included an objective to increase proportion of students that have received the HPV vaccine (American College Health Association 2018). To accomplish this, using risk perceptions about HPV infection for HPV vaccine interventions may be an appropriate strategy for women. For instance, a previous online experiment evaluated the use of evidence or narratives type messages on HPV risk perception and HPV vaccination intention among unvaccinated college women and men. These findings showed that a combination of statistical evidence and narratives was significantly more useful at increasing participants' perceptions of risk towards HPV infection compared to either one of them, and may be a useful strategy for promoting HPV vaccination among this population (Nan et al. 2015). While relationship status was not found to be a significant factor for risk perception among men in this sample, the findings from Nan et al. (2015) indicate that evidence and narrative interventions may adjust men's risk perceptions and vaccine intentions, which warrants further investigation for catch-up age men (Nan et al. 2015).

Since the emergence of HIV, public health prevention messaging has strongly encouraged mutual monogamy and reducing the number of sex partners as effective strategies to lower the risk of HIV and other sexually transmitted infections (STI) (Bolton 1992; Centers for Disease Control and Prevention 2016; Morris and Kretzschmar 1997). However, research shows that young adults in committed, monogamous relationships were less likely to engage in other protective behaviors, such as condom use and STI testing, due to diminished perceptions of risk (Denny-Smith et al. 2006; Lehmiller 2015; Ott et al. 2011; Swan and Thompson 2016; Warren et al. 2012). Furthermore, women who perceived themselves at lower risk were less likely to participate in primary prevention (i.e., HPV vaccine) and secondary prevention (i.e., pap smear) for HPV and HPV-related cervical cancer (Laz et al. 2013; Liddon et al. 2012; Marlow et al. 2015; Thompson et al. 2017; Wilson et al. 2016). The complex dynamics between risk perception, relationship status, and protective behaviors highlight the need to improve HPV vaccination uptake. This strategy includes developing and testing HPV vaccination messaging, specifically for adolescent and young adult women, that HPV vaccination is recommended regardless of relationship status, as this was shown to be a potential barrier in this study.

There are limitations to acknowledge in this study. While this analysis aimed to assess the connection between relationship status and HPV risk perceptions quantitatively, the sample size was limited in some sub-groups of participants, such as men. Despite the smaller sample size, this study permitted a comparison of HPV risk perceptions by gender, relationship status, and vaccination status. Additionally, this study used a convenience sample of college students who completed the question subsets on HPV vaccination and may not be generalizable to young adults in the US. The psychometric properties of the measures used in this study for risk perception have not been

assessed as these few items were added to a longer survey of sexual and reproductive health. Risk perceptions and relationship status were also measured cross-sectionally, and these factors may vary over time. Future research should develop reliable and valid measures that can be used longitudinally to understand how relationship status and HPV risk perception vary over time. Finally, vaccination status was self-reported and not verified by clinical records as these data are not routinely collected on college campuses. As a result, misclassification of vaccination status may have occurred (Stupiansky et al. 2012). Rolnick et al. (2013) compared self-reported HPV vaccination status and medical records among young adult women to find self-reported sensitivity at 91.2% and specificity 76.1%.

With the HPV vaccine's availability spanning over a decade and suboptimal vaccination uptake among adolescents, continued efforts are needed to promote catch-up vaccination among young adults. Understanding HPV risk perception barriers may inform future cancer prevention interventions for young adults who now possess the autonomy for vaccine decisions.

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Compliance with ethical standards

Conflict of interest Erika L. Thompson, Cheryl A. Vamos, Rumour Piepenbrink, Mika Kadono, Coralia Vázquez-Otero, Sarah Matthes and Ellen M. Daley have no conflicts to disclose.

Human and animal rights and Informed consent All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

References

American College Health Association. (2018). Healthy campus 2020: Student objectives. Retrieved from https://www.acha.org/HealthyCampus/Objectives/Student_Objectives/HealthyCampus/Student_Objectives.aspx?hkey=a9f191de-243b-41c6-b913-c012961ecab9. Accessed 21 June 2018.

Barnard, M., George, P., Perryman, M. L., & Wolff, L. A. (2017). Human papillomavirus (HPV) vaccine knowledge, attitudes, and uptake in college students: Implications from the precaution adoption process model. *PLoS ONE, 12,* e0182266.

Bernat, D. H., Gerend, M. A., Chevallier, K., Zimmerman, M. A., & Bauermeister, J. A. (2013). Characteristics associated with initiation of the human papillomavirus vaccine among a national sample of male and female young adults. *Journal of Adolescent Health, 53,* 630–636.

Bolton, R. (1992). AIDS and promiscuity: Muddles in the models of HIV prevention. *Medical Anthropology, 14,* 145–223.

Centers for Disease Control and Prevention. (2016). CDC fact sheet: New HIV infections in the United States. Retrieved from https://www.cdc.gov/nchhstp/newsroom/docs/factsheets/new-hiv-infections-508.pdf. Accessed 21 June 2018.

Chesson, H. W., Dunne, E. F., Hariri, S., & Markowitz, L. E. (2014). The estimated lifetime probability of acquiring human papillomavirus in the United States. *Sexually Transmitted Diseases, 41,* 660–664.

Denny-Smith, T., Bairan, A., & Page, M. C. (2006). A survey of female nursing students' knowledge, health beliefs, perceptions of risk, and risk behaviors regarding human papillomavirus and cervical cancer. *Journal of the American Association of Nurse Practitioners, 18,* 62–69.

Fontenot, H. B., Fantasia, H. C., Charyk, A., & Sutherland, M. A. (2014). Human papillomavirus (HPV) risk factors, vaccination patterns, and vaccine perceptions among a sample of male college students. *Journal of American College Health, 62,* 186–192.

Fontenot, H. B., & Morelock, N. (2012). HPV in men is a women's health issue. *Nursing for Women's Health, 16,* 57–65.

Gunasekaran, B., Jayasinghe, Y., Brotherton, J. M., Fenner, Y., Moore, E. E., Wark, J. D., et al. (2015). Asking about human papillomavirus vaccination and the usefulness of registry validation: A study of young women recruited using Facebook. *Vaccine, 33,* 826–831.

Laz, T. H., Rahman, M., & Berenson, A. B. (2013). Human papillomavirus vaccine uptake among 18- to 26-year-old women in the United States: National Health Interview Survey, 2010. *Cancer, 119,* 1386–1392.

Lehmiller, J. J. (2015). A comparison of sexual health history and practices among monogamous and consensually nonmonogamous sexual partners. *The Journal of Sexual Medicine, 12,* 2022–2028.

Liddon, N. C., Hood, J. E., & Leichliter, J. S. (2012). Intent to receive HPV vaccine and reasons for not vaccinating among unvaccinated adolescent and young women: Findings from the 2006–2008 National Survey of Family Growth. *Vaccine, 30,* 2676–2682.

Manhart, L. E., Burgess-Hull, A. J., Fleming, C. B., Bailey, J. A., Haggerty, K. P., & Catalano, R. F. (2011). HPV vaccination among a community sample of young adult women. *Vaccine, 29,* 5238–5244.

Marlow, L. A., Waller, J., & Wardle, J. (2015). Barriers to cervical cancer screening among ethnic minority women: A qualitative study. *Journal of Family Planning and Reproductive Health Care, 41,* 248–254.

Morris, M., & Kretzschmar, M. (1997). Concurrent partnerships and the spread of HIV. *AIDS, 11,* 641–648.

Munoz, N., Bosch, F. X., de Sanjose, S., Herrero, R., Castellsague, X., Shah, K. V., et al. (2003). Epidemiologic classification of human papillomavirus types associated with cervical cancer. *New England Journal of Medicine, 348,* 518–527.

Nan, X., Dahlstrom, M. F., Richards, A., & Rangarajan, S. (2015). Influence of evidence type and narrative type on HPV risk perception and intention to obtain the HPV vaccine. *Health Communication, 30,* 301–308.

Newman, P. A., Logie, C. H., Doukas, N., & Asakura, K. (2013). HPV vaccine acceptability among men: A systematic review and meta-analysis. *Sexually Transmitted Infections, 89,* 568–574.

Ott, M. A., Katschke, A., Tu, W., & Fortenberry, J. D. (2011). Longitudinal associations among relationship factors, partner

change, and sexually transmitted infection acquisition in adolescent women. *Sexually Transmitted Diseases, 38,* 153–157.

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

Rolnick, S. J., Parker, E. D., Nordin, J. D., Hedblom, B. D., Wei, F., Kerby, T., et al. (2013). Self-report compared to electronic medical record across eight adult vaccines: Do results vary by demographic factors? *Vaccine, 31,* 3928–3935.

Satterwhite, C. L., Torrone, E., Meites, E., Dunne, E. F., Mahajan, R., Ocfemia, M. C., et al. (2013). Sexually transmitted infections among US women and men: Prevalence and incidence estimates, 2008. *Sexually Transmitted Diseases, 40,* 187–193.

Schmidt, S., & Parsons, H. M. (2014). Vaccination interest and trends in human papillomavirus vaccine uptake in young adult women aged 18 to 26 years in the United States: An analysis using the 2008–2012 National Health Interview Survey. *American Journal of Public Health, 104,* 946–953.

Stupiansky, N. W., Zimet, G. D., Cummings, T., Fortenberry, J. D., & Shew, M. (2012). Accuracy of self-reported human papillomavirus vaccine receipt among adolescent girls and their mothers. *Journal of Adolescent Health, 50,* 103–105.

Swan, D. J., & Thompson, S. C. (2016). Monogamy, the protective fallacy: Sexual versus emotional exclusivity and the implication for sexual health risk. *Journal of Sex Research, 53,* 64–73.

Thompson, E. L., Vamos, C. A., Sappenfield, W. M., Straub, D. M., & Daley, E. M. (2016). Relationship status impacts primary reasons for interest in the HPV vaccine among young adult women. *Vaccine, 34,* 3119–3124.

Thompson, E. L., Vamos, C. A., StraubDM, Sappenfield, W. M., & Daley, E. M. (2017). "We've Been Together. We Don't Have It. We're Fine." How relationship status impacts human papillomavirus vaccine behavior among young adult women. *Womens Health Issues, 27,* 228–236.

Viens, L. J., Henley, S. J., Watson, M., Markowitz, L. E., Thomas, C. C., Thompson, T. D., et al. (2016). Human papillomavirus-associated cancers—United States, 2008–2012. *MMWR Morbidity and Mortality Weekly Report, 65,* 661–666.

Walker, T. Y., Elam-Evans, L. D., Singleton, J. A., Yankey, D., Markowitz, L. E., Fredua, B., et al. (2017). National, regional, state, and selected local area vaccination coverage among adolescents aged 13–17 years—United States, 2016. *MMWR Morbidity and Mortality Weekly Report, 66,* 874–882.

Warren, J. T., Harvey, S. M., & Agnew, C. R. (2012). One love: Explicit monogamy agreements among heterosexual young adult couples at increased risk of sexually transmitted infections. *Journal of Sex Research, 49,* 282–289.

Williams, W. W., Lu, P. J., O'Halloran, A., Kim, D. K., Grohskopf, L. A., Pilishvili, T., et al. (2017). Surveillance of vaccination coverage among adult populations—United States, 2015. *MMWR Surveillance Summaries, 66,* 1–28.

Wilson, A. R., Hashibe, M., Bodson, J., Gren, L. H., Taylor, B. A., Greenwood, J., et al. (2016). Factors related to HPV vaccine uptake and 3-dose completion among women in a low vaccination region of the USA: An observational study. *BMC Womens Health, 16,* 41.

Zimet, G. D., Weiss, T. W., Rosenthal, S. L., Good, M. B., & Vichnin, M. D. (2010). Reasons for non-vaccination against HPV and future vaccination intentions among 19–26 year-old women. *BMC Womens Health, 10,* 27.