HHS Public Access

Author manuscript

J Behav Med. Author manuscript; available in PMC 2017 June 01.

Published in final edited form as:

J Behav Med. 2016 June ; 39(3): 429–440. doi:10.1007/s10865-016-9716-z.

The role of anticipated regret and health beliefs in HPV vaccination intentions among young adults

Shannon M. Christy[1,2], **Joseph G. Winger**[2], **Elizabeth W. Raffanello**[3], **Leslie F. Halpern**[3], **Sharon Danoff-Burg**[4], and **Catherine E. Mosher**[2]

[1]Health Outcomes and Behavior Program, Division of Population Science, Moffitt Cancer Center and Research Institute, 12902 Magnolia Dr., MRC-CANCONT, Tampa, FL 33612, USA

[2]Department of Psychology, Indiana University-Purdue University Indianapolis, Indianapolis, IN, USA

[3]Department of Psychology, University at Albany-SUNY, Albany, NY, USA

[4]New Knowledge Organization, Oceanside, CA, USA

Abstract

Although cognitions have predicted young adults' human papillomavirus (HPV) vaccine decision-making, emotion-based theories of healthcare decision-making suggest that anticipatory emotions may be more predictive. This study examined whether anticipated regret was associated with young adults' intentions to receive the HPV vaccine above and beyond the effects of commonly studied cognitions. Unvaccinated undergraduates (N = 233) completed a survey assessing Health Belief Model (HBM) variables (i.e., perceived severity of HPV-related diseases, perceived risk of developing these diseases, and perceived benefits of HPV vaccination), anticipatory emotions (i.e., anticipated regret if one were unvaccinated and later developed genital warts or HPV-related cancer), and HPV vaccine intentions. Anticipated regret was associated with HPV vaccine intentions above and beyond the effects of HBM variables among men. Among women, neither anticipated regret nor HBM variables showed consistent associations with HPV vaccine intentions. Findings suggest that anticipatory emotions should be considered when designing interventions to increase HPV vaccination among college men.

Keywords

Human papillomavirus vaccination; Health behavior; Anticipated regret; Health Belief Model; Sexual health

Shannon M. Christy, shannon.christy@moffitt.org.

A portion of the findings were presented at the 2013 American Psychological Association conference in Honolulu, Hawaii.

Compliance with ethical standards

Conflict of interest Shannon M. Christy, Joseph G. Winger, Elizabeth W. Raffanello, Leslie F. Halpern, Sharon Danoff-Burg, and Catherine E. Mosher declare that they have no conflict of interest.

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 patients for being included in the study.

Introduction

Human papillomavirus (HPV) is the most common sexually transmitted infection, with the majority of sexually active individuals contracting the virus at some point in their lifetime (Centers for Disease Control and Prevention, 2015). The quadrivalent HPV vaccine guards against HPV strains linked to genital warts and several cancers including cervical, oral, anal, and penile cancers (US Food and Drug Administration, 2011), whereas the bivalent HPV vaccine was approved to guard against HPV strains linked to cervical cancer (US Food and Drug Administration, 2013). The quadrivalent HPV vaccine, Gardasil, was approved for females aged 9–26 in 2006 and males aged 9–26 in 2009 (US Food and Drug Administration, 2011). Additionally, in 2009, the bivalent HPV vaccine, Cervarix, was approved for females aged 9–25 (US Food and Drug Administration, 2013). Most recently, a nonavalent vaccine, Gardasil 9, was approved for females aged 9–26 and males 9–15 in 2014 (US Food and Drug Administration, 2015). Each vaccine type requires three doses over the course of 6 months (Centers for Disease Control and Prevention, 2015).

Compared to other age groups, individuals aged 20–24 are at highest risk for contracting HPV (53.8 % prevalence rate) (Satterwhite et al., 2013). More than 32 % of college women experience first-time incidence of HPV within the first 2 years of college (Winer et al., 2003). Women are more likely than men to have some knowledge of HPV and the HPV vaccine (Bynum et al., 2011; Reimer et al., 2014) and to have taken steps toward receiving the HPV vaccine (Patel et al., 2013). However, HPV vaccine uptake among both males and females has remained low (Btoush et al., 2015; Fontenot et al., 2014; Lindley et al., 2013; Ratanasiripong, 2015; Reiter et al., 2013; Schmidt & Parsons, 2014) with only 45 % of female college students and 26 % of male college students reporting receipt of the HPV vaccine (Fontenot et al., 2014; Lindley et al., 2013).

Correlates of HPV vaccine uptake and intentions among college students have been studied largely within the framework of the Health Belief Model (HBM) (Donadiki et al., 2014; Krawczyk et al., 2012; Mehta et al., 2013). Developed in the 1950s, the HBM has been widely used as a conceptual framework to examine and predict individuals' willingness to engage in protective health behaviors (Janz & Becker, 1984). The HBM proposes that cognitive variables are central to people's decision-making regarding their health behaviors (Janz & Becker, 1984). Commonly studied cognitive variables include perceived risk of developing an illness, perceived benefits of taking action against developing an illness, and perceived barriers to taking action (Donadiki et al., 2014; Krawczyk et al., 2012). Knowledge of the illness and associated behavior as well as cues to action (e.g., physician recommendation, family/friend recommendation, reminder postcard) are also included in the HBM (Champion & Skinner, 2008). In addition, self-efficacy, or the belief that one can take the steps necessary to complete an action, was added to the HBM in order to more fully capture individuals' willingness to engage in health behaviors (Janz & Becker, 1984).

In prior studies using the HBM, HPV vaccination behaviors and intentions have been examined among young men and women separately (Bennett et al., 2012; Donadiki et al., 2014; Mehta et al., 2013). Consistent with the HBM, greater perceived barriers to HPV vaccination and fewer perceived benefits of vaccination have been associated with non-

receipt of the HPV vaccine among female college students (Donadiki et al., 2014). Furthermore, female college students' intentions to receive the HPV vaccine have been associated with perceived risk of developing HPV, perceived benefits of receiving the vaccine, and self-efficacy for receiving the vaccine (Bennett et al., 2012). HBM variables have also been correlated with men's intentions to receive the HPV vaccine (Mehta et al., 2013). Specifically, in a study evaluating an HBM-based intervention to promote HPV vaccination in college men, HPV vaccine acceptability was associated with perceived severity of HPV, perceived barriers to receiving the vaccine, and self-efficacy for receiving the vaccine (Mehta et al., 2013).

The role of emotions, specifically anticipated regret, also has been considered in relation to adults' willingness to receive the HPV vaccine (Gilbert et al., 2011; Reiter et al. 2010a, b). For example, anticipated regret if one did not receive the HPV vaccine and subsequently developed an HPV infection was associated with willingness to receive the vaccine among US men aged 18–59 (Reiter et al. 2010a, b). Additionally, among lesbian and bisexual women aged 18–26, anticipated regret if one did not receive the HPV vaccine and subsequently contracted HPV was associated with receiving at least 1 dose of the HPV vaccine (McRee et al., 2014).

Although both emotions and cognitions have been correlated with HPV vaccine uptake and intentions (Bennett et al., 2012; Donadiki et al., 2014; Gilbert et al., 2011; Mehta et al., 2013; Reiter et al. 2010a, b), prior studies have not examined the theoretical assumption that anticipatory emotions, such as anticipated regret, influence HPV vaccine decision-making above and beyond the effects of cognitive factors (Schwarz, 2000). Examination of this assumption would have implications for the design of interventions to improve vaccine uptake. Research on other preventive health behaviors (e.g., physical activity, HIV prevention, and smoking cessation as well as flu vaccination) has supported this theoretical assumption (Chapman & Coups, 2006; Janssen et al., 2014; Richard et al., 1995; Wang, 2011; Weinstein et al., 2007). For example, one study of university employees found that anticipated regret and worry were stronger predictors of flu vaccination than perceived risk and that these emotions mediated the relationship between perceived risk and flu vaccination (Chapman & Coups, 2006).

The extent to which cognitive factors (e.g., perceived severity of HPV-related diseases, perceived risk of developing these diseases) are associated with anticipatory emotions regarding HPV vaccination also requires study, especially in high-risk populations such as college students (Satterwhite et al., 2013). Such relationships should be examined by gender, as college women have more knowledge of HPV and the HPV vaccine compared to college men (Bynum et al., 2011; Reimer et al., 2014), and the vaccine has primarily been marketed to women and girls (Gottlieb, 2013). Thus, the current study draws upon the HBM (Hochbaum, 1958; Janz & Becker, 1984; Rosenstock, 1960) and emotion-based decision-making theories (Anderson, 2003) to examine college students' intentions to receive the HPV vaccine by gender. The study aims are: (1) to examine the extent to which commonly studied HBM variables (i.e., perceived severity of HPV-related diseases, perceived risk of developing these diseases, and perceived benefits of HPV vaccination) are associated with anticipated regret if one were unvaccinated and later developed genital warts or an HPV-

related cancer; and (2) to examine whether anticipated regret is associated with HPV vaccine intentions above and beyond the effects of the three HBM variables. Analyses for each aim were conducted separately for college men and women.

Methods

Participants and procedure

Undergraduates at a state university in the northeastern United States were recruited through a psychology department research participant pool. Students fulfilled course requirements or received extra credit for their participation. All participants were fluent in English and 18 years of age or older.

The university's institutional review board approved study procedures. Following an informed consent process, participants anonymously completed a 15–30 min online survey. The survey was completed in groups ranging from 1–16 participants in a campus computer lab. Data were collected from March 2011 through April 2012.

Measures

HPV vaccination—Following a description of HPV vaccination, participants first indicated whether they had heard of the HPV vaccine prior to study participation (Centers for Disease Control and Prevention, 2008). Having heard of the HPV vaccine was coded as 0 = no and 1 = yes. Those who had heard of the HPV vaccine were asked to indicate whether they had received the vaccine (Centers for Disease Control and Prevention, 2008). Participants who had not heard of the vaccine and those who had not received the vaccine were coded as unvaccinated.

HPV vaccination intention—Unvaccinated participants rated their intention to ask their doctor for the HPV vaccine on a 5-point scale ranging from "not at all likely" to "extremely likely" (Zimet et al., 2010). This measure has been used to assess HPV vaccination intention among women aged 19–26 years old receiving care through a large, nationwide healthcare plan (Zimet et al., 2010).

Anticipated regret—Two items assessed anticipated regret if one were unvaccinated and later contracted genital warts or an HPV-related cancer (i.e., oral, anal, or penile cancer in the case of men or oral, anal, or cervical cancer in the case of women) (Reiter et al. 2010a). Items were rated on 4-point scales ranging from "not at all" to "quite a lot" (Reiter et al. 2010a).

Health Belief Model variables

Perceived severity—Four items assessed beliefs about the perceived severity of HPV-related diseases (i.e., genital warts, oral cancer, anal cancer, and penile cancer in the case of men or genital warts, oral cancer, anal cancer, and cervical cancer in the case of women) (Reiter et al. 2010a). For each item, participants indicated how much they believed that the disease would affect their lives using a 4-point scale ranging from "not at all" to "quite a lot" (Reiter et al. 2010a). Perceived severity of HPV-related cancers was then averaged across the

three applicable cancer types separately for men and women. In the current study, Cronbach's alpha for perceived severity of the HPV-related cancers was .90 for men and .87 for women.

Perceived risk—Four items assessed the perceived likelihood of developing genital warts, oral cancer, anal cancer, and penile cancer for men or genital warts, oral cancer, anal cancer, and cervical cancer for women (Reiter et al. 2010a). Perceived risk of developing each of the diseases was rated on a 5-point scale ranging from "no chance" to "certain I will get" (Reiter et al. 2010a). Responses to items assessing perceived risk of developing an HPV-related cancer were averaged across the three gender-appropriate cancer types for men and women separately. Cronbach's alpha for the perceived risk of developing HPV-related cancers was . 93 for men and .87 for women in the current study.

Perceived benefits—Perceived benefits of receiving the HPV vaccine were assessed with four items (Reiter et al. 2010a). Specifically, participants rated the perceived efficacy of the HPV vaccine for preventing each of four HPV-related diseases (i.e., genital warts, oral cancer, anal cancer, and penile cancer in the case of men or genital warts, oral cancer, anal cancer, and cervical cancer in the case of women) using a 5-point scale ranging from "no protection" to "complete protection" (Reiter et al. 2010a). Perceived benefits of receiving the HPV vaccine were averaged across the cancer types separately for men and women. In the current study, Cronbach's alpha for perceived efficacy of the vaccine for preventing HPV-related cancers was .92 for men and .77 for women.

Statistical analyses

Statistical analyses were conducted using SPSS statistical software (SPSS Inc., 2011, 2012, versions 20 and 21, Chicago, IL). Only data from students who had not received the HPV vaccination were analyzed. Thus, data from 196 women and 28 men who reported receiving the HPV vaccine were excluded from analyses. In addition, data from two unvaccinated men and five unvaccinated women with a reported age category of "25 years or older" were excluded from analyses because their eligibility status for the vaccine was unknown, as the vaccine was only approved for individuals up to 26 years of age (US Food and Drug Administration, 2011).

Descriptive statistics for study variables and zero-order correlations between variables were computed by gender. Regression analyses also were conducted separately for men and women, and whether participants had heard of the HPV vaccine prior to study participation was included as a covariate. To address aim 1, a hierarchical multiple regression analysis was conducted for each disease type (i.e., genital warts or HPV-related cancer) to examine the extent to which three HBM variables (i.e., perceived severity, risk, and benefits) were associated with anticipated regret. Prior awareness of the HPV vaccine was entered in the first step of the equation and the HBM variables were entered in the second step. Then, to address aim 2, a hierarchical multiple regression analysis was conducted for each disease type (i.e., genital warts or HPV-related cancer) to examine whether anticipated regret was associated with HPV vaccine intentions above and beyond the effects of the three HBM variables. Prior awareness of the HPV vaccine was entered in the first step of the equation,

followed by the HBM variables (i.e., perceived severity, risk, and benefits) in the second step and anticipated regret in the third step.

Post-hoc power analyses were conducted using G*Power statistical software (Heinrich-Heine-Universität Düsseldorf, 2014, version 3.1.9.2, Düsseldorf, Germany). Power ranged from 58 to 95 % for the analyses conducted with male participants and from 29 to 99 % for the analyses conducted with female participants (Faul, Erdfelder, Buchner, & Lang, 2009).

Results

Sample characteristics

Participants were 233 undergraduates (149 men and 84 women) who had not received the HPV vaccine. Demographic characteristics are listed in Table 1. Briefly, most participants were 18–19 years old (67 %) and had health insurance (92 %). Participants were primarily single (96 %), and the majority had engaged in sexual intercourse at least once (81 %) and self-identified as heterosexual (94 %). Participants reported the following racial/ethnic backgrounds: White (56 %), Asian (16 %), Hispanic or Latino/a (9 %), Black or African American (9 %), and other or more than one race (9 %). Among women, 82 % had heard of the HPV vaccine prior to study participation, whereas 66 % of men had heard of the HPV vaccine prior to study participation. A total of seven participants (3 % of the total sample) reported an HPV diagnosis (6 women, 1 man).

Preliminary analyses

Means, standard deviations, and Pearson's correlations between study variables are listed for men and women in Tables 2 and 3, respectively. Variables that were positively correlated with men's HPV vaccine intentions included perceived benefits with respect to cancer risk reduction and anticipated regret if one were unvaccinated and later developed genital warts or an HPV-related cancer (see Table 2). Variables that were positively correlated with women's HPV vaccine intentions included perceived risk of developing genital warts or an HPV-related cancer, perceived benefits with respect to genital warts and cancer risk reduction, and anticipated regret if one were unvaccinated and later developed genital warts (see Table 3).

Relations of HBM variables to anticipated regret

First, HBM variables (i.e., perceived severity of HPV-related diseases, perceived risk of developing these diseases, and perceived benefits of HPV vaccination) were examined in relation to anticipated regret if one were unvaccinated and later developed genital warts or an HPV-related cancer. Results of these hierarchical multiple regression analyses are presented by gender in Table 4; each set of HBM variables was significantly associated with anticipated regret. Among men, the same pattern of results was obtained across disease types (i.e., genital warts or HPV-related cancer). Specifically, perceived severity was positively associated with anticipated regret, whereas perceived risk and perceived benefits were unrelated to this variable. Results for women also did not vary across disease types (i.e., genital warts or HPV-related cancer); perceived severity and perceived benefits were positively associated with anticipated regret, whereas perceived risk was unrelated to this

variable. Across analyses, the control variable (i.e., whether participants had heard of the vaccine prior to study participation) was unrelated to anticipated regret among both men and women.

Relations of study variables to HPV vaccine intentions

Next, hierarchical regression analyses were used to examine whether anticipated regret was associated with HPV vaccine intentions above and beyond the effects of the three HBM variables among men. The overall models were significant (see Table 5). With regard to genital warts, anticipated regret was positively associated with vaccine intentions when controlling for the three HBM variables and prior awareness of the vaccine. None of the HBM variables or prior awareness of the vaccine were related to this outcome. With regard to HPV-related cancer, anticipated regret was positively associated with vaccine intentions when controlling for the three HBM variables and prior awareness of the vaccine. In the final model, none of the HBM variables or prior awareness of the HPV vaccine were associated with vaccine intentions.

The same hierarchical regression analyses were conducted to examine women's vaccine intentions and, although the overall models were significant, a different pattern of results was found (see Table 5). With regard to genital warts, anticipated regret was not significantly associated with vaccine intentions when controlling for HBM variables and prior awareness of the vaccine, and none of the variables were associated with vaccine intentions in the final model. The same pattern of findings was obtained with respect to HPV-related cancer, except that perceived benefits of the vaccine were positively associated with vaccine intentions in the final model.

Discussion

The current study examined a core assumption of emotion-based theories of healthcare decision-making, namely that anticipatory emotions such as regret are associated with healthcare intentions above and beyond the effects of health-related cognitions (Schwarz, 2000). This assumption was examined with respect to HPV vaccine intentions in male and female college students, a population at high risk of HPV infection (Satterwhite et al., 2013; Winer et al., 2003). Results showed that anticipated regret was associated with HPV vaccine intentions above and beyond the effects of cognitive factors central to the HBM (i.e., perceived severity of HPV-related diseases, perceived risk of developing these diseases, and perceived benefits of HPV vaccination) in college men, but not college women. Neither the HBM variables, nor prior awareness of the HPV vaccine, were associated with men's vaccine intentions. Among women, neither anticipated regret nor the three HBM variables were consistently associated with HPV vaccine intentions. Prior awareness of the HPV vaccine also was not associated with vaccine intentions among women. Taken together, findings suggest that, among men, anticipatory emotions may play a more central role in decision-making regarding HPV vaccination than cognitions related to vaccination. In prior research (Bynum et al., 2011; Reimer et al., 2014), men have reported limited knowledge of the vaccine, and only 66 % of men had heard of the vaccine prior to participating in the

current study. Thus, for some men, emotional reactions to novel information about the vaccine may have led to increased vaccine intentions.

Among women, only perceived benefits with respect to cancer risk reduction showed consistent associations with HPV vaccine intentions. These findings are similar to prior results with female college students (Bennett et al., 2012; Donadiki et al., 2014) and likely reflect the marketing of the HPV vaccine as an intervention to reduce cervical cancer risk. Given women's knowledge of the HPV vaccine, those who are unvaccinated may be especially challenging to motivate or may be making their decision based upon unassessed factors such as religious beliefs. Among women, perceived severity of HPV-related diseases was consistently unrelated to HPV vaccine intentions, as found in prior research (Bennett et al., 2012; Donadiki et al., 2014). On average, women perceived HPV-related diseases as severe, and, thus, findings may be related to limited variability in these perceptions.

Perceived severity of HPV-related diseases and other cognitive factors were also examined in relation to anticipated regret. Among both men and women, greater perceived severity of HPV-related diseases was consistently associated with higher levels of anticipated regret. Students in this study were informed that HPV causes genital warts and HPV-related cancers and that a vaccination to prevent HPV exists; thus, it is not surprising that those perceiving these diseases as more severe endorsed higher levels of anticipated regret if they were to forgo the vaccine. Additionally, among women, greater perceived benefits of the vaccine were associated with higher levels of anticipated regret. The consistency of this finding across analyses for women may reflect their knowledge of the vaccine. Our results provide initial information on health beliefs related to anticipated regret in college students. Findings suggest that, among male and female college students, heightening awareness of the severity of HPV-related diseases may result in greater anticipated regret associated with forgoing HPV vaccination.

Limitations of the current study and directions for future research should be noted. First, although the sample was diverse with respect to ethnicity and gender, participants were attending one university in the northeastern U.S. Thus, the extent to which findings generalize to college students in other geographical locations requires study. Second, the current study did not include certain HBM constructs (e.g., self-efficacy); therefore, further research is needed to examine their relation to anticipated regret and HPV vaccine intentions. In addition, although participants reported whether they had heard of the HPV vaccine, their knowledge of HPV and HPV vaccination was not examined. However, participants were provided with a description of the HPV vaccine prior to items assessing vaccination status and other study variables. Third, the current study relied on self-report measures. However, a recent study suggested a high rate of concordance between self-report and electronic medical record data for HPV vaccination among young women (age 18–26) with 57.9 % of study participants self-reporting receipt of HPV vaccination and 55.7 % of participants receiving the HPV vaccination according to electronic medical record data (Rolnick et al., 2013). Fourth, sample sizes may have reduced statistical power for detecting effects; post hoc power analyses suggested that three of the eight models were underpowered. Finally, longitudinal studies are needed to establish the predictive value of cognitive and emotional factors in HPV vaccine intentions and receipt.

The current findings carry implications for future intervention research to promote HPV vaccination in college students. Specifically, results suggest that interventions which only address beliefs about the HPV vaccine may not be sufficient for promoting HPV vaccination among young men. To date, most HPV vaccine interventions for young adults have focused on educating participants about their risk for developing HPV and the availability of the HPV vaccine (Gross et al., 2014; Kester et al., 2014). For example, interventions have involved listening to professional lectures or receiving fact sheets on HPV vaccination (Gross et al., 2014; Kester et al., 2014). The degree to which these interventions have increased young adults' HPV vaccine uptake and intentions has been variable (Gross et al., 2014; Kester et al., 2014). Furthermore, results of a systematic review of educational interventions to promote HPV vaccination in various populations, including young adults, suggested that the effects of these interventions on HPV vaccine intentions may be short-lived (Fu et al., 2014). Thus, education regarding the vaccine may not adequately promote uptake.

The present findings also suggest that interventions targeting anticipatory emotions (e.g., anticipated regret, worry) should be considered as an alternative to increasing HPV vaccine intentions and behaviors among male college students. For example, an ongoing study is testing the effect of completing a standardized assessment of anticipated regret on breast cancer screening (Chambers et al., 2014); this approach might also be tested with respect to HPV vaccination in college men. Another possible approach to targeting anticipated regret involves asking male college students to write a reflective paragraph about their anticipated regret if they were to forgo the HPV vaccine and were subsequently diagnosed with genital warts or an HPV-related cancer. Alternatively, college men could watch a video of an unvaccinated individual who subsequently developed an HPV-related disease (Cody & Lee, 1990). In this video, the person would reflect upon his beliefs when initially offered the HPV vaccine and emotions, including regret related to forgoing the vaccine. Although our findings suggest that an emotion-based intervention may promote vaccination in men, these implications should be made with caution, given the modest associations between men's anticipated regret and vaccine intentions.

In the current study, anticipated regret was associated with HPV vaccine intentions above and beyond the effects of several cognitive factors central to the HBM in college men, but not college women. Findings of this study and prior research (Bennett et al., 2012; Donadiki et al., 2014; Fisher et al., 2013; Gilbert et al., 2011; Loewenstein et al., 2001; Mehta et al., 2013; Reiter et al. 2010a, b) suggest that future research on HPV vaccine decision-making in college students should draw upon emotion-based theories of decision-making (Anderson, 2003; Schwarz, 2000) in addition to cognitively-based health behavior theories (Hochbaum, 1958; Janz & Becker, 1984; Rosenstock, 1960). In addition, potential gender differences in correlates of HPV vaccination should be considered, especially given the greater awareness of the vaccine among women relative to men and previously documented gender differences in emotions, cognitions, intentions, and behaviors related to disease prevention (Cody & Lee, 1990; Courtenay et al., 2002; McQueen et al., 2008). Understanding factors associated with greater HPV vaccine intentions and uptake in college students may lead to more efficacious interventions to promote vaccination and ultimately reduce incidence and mortality from HPV-related diseases.

Acknowledgments

The work of the first author was funded initially by R25CA117865 (V. Champion, PI) and subsequently by R25CA090314 (P. Jacobsen, PI) from the National Cancer Institute. The work of the second author was funded by a fellowship from the Behavioral Cooperative Oncology Group Center for Symptom Management and the Walther Cancer Foundation. The work of the last author was funded by K07CA168883 (C. Mosher, PI) and K05CA175048 (V. Champion, PI) from the National Cancer Institute. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Cancer Institute.

References

Anderson CJ. The psychology of doing nothing: Forms of decision avoidance result from reason and emotion. Psychological Bulletin. 2003; 129:139–167. doi:10.1037/0033-2909.129.1.139. [PubMed: 12555797]

Bennett KK, Buchanan JA, Adams AD. Social-cognitive predictors of intention to vaccinate against the human papillomavirus in college-age women. Journal of Social Psychology. 2012; 152:480–492. doi:10.1080/00224545.2011.639408. [PubMed: 22822686]

Btoush RM, Brown DR, Fogarty S, Carmody DP. Initiation of Human Papillomavirus vaccination among predominantly minority female and male adolescents at inner-city community health centers. American Journal of Public Health. 2015 doi:10.2105/AJPH.2015.302584.

Bynum SA, Brandt HM, Friedman DB, Annang L, Tanner A. Knowledge, beliefs, and behaviors: Examining human papillomavirus-related gender differences among African American college students. Journal of American College Health. 2011; 59:296–302. doi: 10.1080/07448481.2010.503725. [PubMed: 21308590]

Centers for Disease Control and Prevention. 2008 National Immunization Survey-Teen Hard Copy Questionnaire. Centers for Disease Control and Prevention; Hyattsville, MD: 2008.

Centers for Disease Control and Prevention. Genital HPV infection—Fact sheet. 2015. Retrieved September 9, 2015, from http://www.cdc.gov/std/hpv/stdfact-hpv.htm

Chambers JA, O'Carroll RE, Cook A, Cavanagh J, Archibald D, Millar R. A pilot telephone intervention to increase uptake of breast cancer screening in socially deprived areas in Scotland (TELBRECS): Study protocol for a randomised controlled trial. BMC Public Health. 2014; 14:824. doi:10.1186/1471-2458-14-824. [PubMed: 25106506]

Champion, VL.; Skinner, CS. The Health Belief Model. In: Glanz, K.; Rimer, BK.; Viswanath, K., editors. Health behavior and health education: Theory, research and practice. Jossey-Bass/Wiley; San Francisco, CA: 2008. p. 45-66.

Chapman GB, Coups EJ. Emotions and preventive health behavior: Worry, regret, and influenza vaccination. Health Psychology. 2006; 25:82–90. doi:10.1037/0278-6133.25.1.82. [PubMed: 16448301]

Cody R, Lee C. Behaviors, beliefs, and intentions in skin cancer prevention. Journal of Behavioral Medicine. 1990; 13:373–389. doi:10.1007/BF00844885. [PubMed: 2246784]

Courtenay WH, McCreary DR, Merighi JR. Gender and ethnic differences in health beliefs and behaviors. Journal of Health Psychology. 2002; 7:219–231. doi:10.1177/1359105302007003216. [PubMed: 22114246]

Donadiki EM, Jiménez-García R, Hernández-Barrera V, Sourtzi P, Carrasco-Garrido P, López de Andrés A, Velonakis EG. Health Belief Model applied to non-compliance with HPV vaccine among female university students. Public Health. 2014; 128:268–273. doi:10.1016/j.puhe. 2013.12.004. [PubMed: 24529635]

Faul F, Erdfelder E, Buchner A, Lang A-G. Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. Behavior Research Methods. 2009; 41:1149–1160. [PubMed: 19897823]

Fisher WA, Kohut T, Salisbury CM, Salvadori MI. Understanding human papillomavirus vaccination intentions: Comparative utility of the theory of reasoned action and the theory of planned behavior in vaccine target age women and men. The Journal of Sexual Medicine. 2013; 10:2455–2464. doi: 10.1111/jsm.12211. [PubMed: 23745833]

Fontenot HB, Fantasia HC, Charyk A, Sutherland MA. Human papillomavirus (HPV) risk factors, vaccination patterns, and vaccine perceptions among a sample of male college students. Journal of American College Health. 2014; 62:186–192. doi:10.1080/07448481.2013.872649. [PubMed: 24328855]

Fu LY, Bonhomme LA, Cooper SC, Joseph JG, Zimet GD. Educational interventions to increase HPV vaccination acceptance: A systematic review. Vaccine. 2014; 32:901–920. doi:10.1016/j.vaccine.2014.01.091. [PubMed: 24412301]

Gilbert P, Brewer NT, Reiter PL, Ng TW, Smith JS. HPV vaccine acceptability in heterosexual, gay, and bisexual men. American Journal of Men's Health. 2011; 5:297–305. doi:10.1177/1557988310372802.

Gottlieb SD. The patient–consumer–advocate nexus: The marketing and dissemination of Gardasil, the Human Papillomavirus Vaccine in the United States. Medical Anthropology Quarterly. 2013; 27:330–347. doi:10.1111/maq.12046. [PubMed: 24248992]

Gross MS, Tran CH, Sutherland KH, Castagno JC, Amdur RJ. Pilot study: Can an educational intervention increase Human Papillomavirus vaccination in female college students? Obstetrics and Gynecology. 2014; 123:1–2. doi:10.1097/01.AOG.0000447062.94587.52. [PubMed: 24463655]

Hochbaum, GM. Public participation in medical screening programs: A sociopsychological study. US Government Printing Office; Washington, D.C.: 1958.

Janssen E, Waters EA, van Osch L, Lechner L, de Vries H. The importance of affectively-laden beliefs about health risks: The case of tobacco use and sun protection. Journal of Behavioral Medicine. 2014; 37:11–21. doi:10.1007/s10865-012-9462-9. [PubMed: 23073599]

Janz NK, Becker MH. The Health Belief Model: A decade later. Health Education & Behavior. 1984; 11:1–47. doi:10.1177/109019818401100101.

Kester LM, Shedd-Steele RB, Dotson-Roberts CA, Smith J, Zimet GD. The effects of a brief educational intervention on human papillomavirus knowledge and intention to initiate HPV vaccination in 18–26 year old young adults. Gynocologic Oncology. 2014; 132:S9–S12. doi:10.1016/j.ygyno.2013.12.033.

Krawczyk AL, Perez S, Lau E, Holcroft CA, Amsel R, Knäuper B, Rosberger Z. Human papillomavirus vaccination intentions and uptake in college women. Health Psychology. 2012; 31:685–693. doi:10.1037/a0027012. [PubMed: 22268713]

Lindley LL, Elkind JS, Landi SN, Brandt HM. Receipt of the human papillomavirus vaccine among female college students in the United States, 2009. Journal of American College Health. 2013; 61:18–27. doi:10.1080/07448481.2012.750607. [PubMed: 23305541]

Loewenstein GF, Weber EU, Hsee CK, Welch N. Risk as feelings. Psychological Bulletin. 2001; 127:267–286. doi:10.1037//0033-2909.127.2.267. [PubMed: 11316014]

McQueen A, Vernon SW, Meissner HI, Rakowski W. Risk perceptions and worry about cancer: Does gender make a difference? Journal of Health Communications. 2008; 13:56–79. doi:10.1080/10810730701807076.

McRee AL, Katz ML, Paskett ED, Reiter PL. HPV vaccination among lesbian and bisexual women: Findings from a national survey of young adults. Vaccine. 2014; 32:4736–4742. doi:10.1016/j.vaccine.2014.07.001. [PubMed: 25038312]

Mehta P, Sharma M, Lee RC. Designing and evaluating a Health Belief Model-based intervention to increase intent of HPV vaccination among college males. International Quarterly of Community Health Education. 2013; 34:101–117. doi:10.2190/IQ.34.1.h. [PubMed: 24366025]

Patel DA, Grunzweig KA, Zochowski MK, Dempsey AF, Carlos RC, Dalton VK. Human papillomavirus vaccine stages of change among male and female university students: Ready or not? Journal of American College Health. 2013; 61:336–346. doi:10.1080/07448481.2013.811244. [PubMed: 23930748]

Ratanasiripong NT. Factors related to Human Papillomavirus (HPV) vaccination in college men. Public Health Nursing. 2015 doi:10.1111/phn.12198.

Reimer RA, Schommer JA, Houlihan AE, Gerrard M. Ethnic and gender differences in HPV knowledge, awareness, and vaccine acceptability among White and Hispanic men and women.

Journal of Community Health. 2014; 39:274–284. doi:10.1007/s10900-013-9773-y. [PubMed: 24150246]

Reiter PL, Brewer NT, McRee AL, Gilbert P, Smith JS. Acceptability of HPV vaccine among a national sample of gay and bisexual men. Sexually Transmitted Diseases. 2010a; 37:197–203. doi: 10.1097/OLQ.0b013e3181bf542c. [PubMed: 20118831]

Reiter PL, Brewer NT, Smith JS. Human papillomavirus knowledge and vaccine acceptability among a national sample of heterosexual men. Sexually Transmitted Infections. 2010b; 86:241–246. doi: 10.1136/sti.2009.039065. [PubMed: 19951936]

Reiter PL, Gilkey MB, Brewer NT. HPV vaccination among adolescent males: results from the National Immunization Survey-Teen. Vaccine. 2013; 31:2816–2821. doi:10.1016/j.vaccine. 2013.04.010. [PubMed: 23602667]

Richard R, van der Pligt J, de Vries N. Anticipated affective reactions and prevention of AIDS. British Journal of Social Psychology. 1995; 34:9–21. doi:10.1111/j.2044-8309.1995.tb01045.x. [PubMed: 7735735]

Rolnick SJ, Parket ED, Nordin JD, Hedblom BD, Wei F, et al. Self-report compared to electronic medical record across eight adult vaccines: Do results vary by demographic factors? Vaccine. 2013; 31:3928–3935. doi:10.1016/j.vaccine.2013.06.041. [PubMed: 23806243]

Rosenstock IM. What research in motivation suggests for public health. American Journal of Public Health and the Nation's Health. 1960; 50:295–302. doi:10.2105/AJPH.50.3_Pt_1.295.

Satterwhite CL, Torrone E, Meites E, Dunne EF, Mahajan R, Ocfemia MC, et al. Sexually transmitted infections among US women and men: Prevalence and incidence estimates, 2008. Sexually Transmitted Diseases. 2013; 40:187–193. doi:10.1097/OLQ.0b013e318286bb53. [PubMed: 23403598]

Schmidt S, Parsons HM. 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. 2014; 104:946–953. doi: 10.2105/AJPH.2013.301828. [PubMed: 24625152]

Schwarz N. Emotion, cognition, and decision making. Cognition and Emotion. 2000; 14:433–440. doi: 10.1080/026999300402745.

US Food and Drug Administration. Vaccines, blood & biologics: Gardasil. 2011. Retrieved May 6, 2014, from http://www.fda.gov/BiologicsBloodVaccines/Vaccines/ApprovedProducts/UCM094042

US Food and Drug Administration. Vaccines, blood & biologics: Cervarix. 2013. Retrieved May 6, 2014, from http://www.fda.gov/biologicsbloodvaccines/vaccines/approvedproducts/ucm186957.htm

US Food and Drug Administration. Vaccines, blood & biologics: Gardasil 9. 2015. Retrieved August 24, 2015, from http://www.fda.gov/BiologicsBloodVaccines/Vaccines/ApprovedProducts/ucm426445.htm

Wang X. The role of anticipated negative emotions and past behavior in individuals' physical activity intentions and behaviors. Psychology of Sport and Exercise. 2011; 12:300–305. doi:10.1016/j.psychsport.2010.09.007.

Weinstein ND, Kwitel A, McCaul KD, Magnan RE, Gerrard M, Gibbons FX. Risk perceptions: Assessment and relationship to influenza vaccination. Health Psychology. 2007; 26:146–151. doi: 10.1037/0278-6133.26.2.146. [PubMed: 17385965]

Winer RL, Lee S, Hughes JP, Adam DE, Kiviat NB, Koutsky LA. Genital Human Papillomavirus infection: Incidence and risk factors in a cohort of female university students. American Journal of Epidemiology. 2003; 157:218–226. doi:10.1093/aje/kwf180. [PubMed: 12543621]

Zimet GD, Weiss TW, Rosenthal SL, Good MB, Vichnin MD. Reasons for non-vaccination against HPV and future vaccination intentions among 19–26 year-old women. BMC Women's Health. 2010; 10:27. doi:10.1186/1472-6874-10-27. [PubMed: 20809965]

Table 1

Sample demographics (N = 233)

Variables	*N* (%)
Age	
18–19	156 (67)
20–21	66 (28)
22–24	11 (5)
Gender	
Male	149 (64)
Female	84 (36)
Race/ethnicity	
White	131 (56)
Asian/Asian-American	38 (16)
Hispanic/Latino	21 (9)
African-American/Black	20 (9)
Other/More than 1 race	20 (9)
Marital status	
Single	224 (96)
Living with partner	7 (3)
Married	1 (<1)
Separated	1 (<1)
Sexual orientation	
Gay/homosexual	3 (1)
Bisexual	4 (2)
Heterosexual	218 (94)
Other/not sure	8 (3)
Health insurance	
Yes	214 (92)
No	19 (8)
Heard of HPV vaccine	
Yes	168 (72)
No	65 (28)
Prior HPV diagnosis	
Yes	7 (3)
No	224 (96)
Currently in a romantic relationship	
Yes	95 (41)
No	138 (59)
Have had at least one sexual experience	
Yes	188 (81)
No	44 (19)

Totals may not add to 100 % due to rounding and/or missing data

Table 2

Intercorrelations and descriptive statistics for study variables among men

	1	2	3	4	5	6	7	8	9	10
1. Intention to ask doctor for HPV vaccine										
Correlation	–									
p value										
2. Perceived severity of genital warts										
Correlation	.02	–								
p value	.82									
3. Perceived risk of genital warts										
Correlation	.16	−.06	–							
p value	.06	.51								
4. Perceived benefits of HPV vaccine against genital warts										
Correlation	.13	.08	−.01	–						
p value	.12	.36	.87							
5. Anticipated regret if unvaccinated and later developed genital warts										
Correlation	**.22**	**.29**	<.01	.16	–					
p value	**.01**	**<.01**	.97	.07						
6. Perceived severity of HPV-related cancer										
Correlation	−.09	**.65**	**−.21**	**.22**	**.31**	–				
p value	.32	**<.01**	**.01**	**.01**	**<.01**					
7. Perceived risk of HPV-related cancer										
Correlation	.11	−.06	**.74**	.07	.10	−.10	–			
p value	.21	.51	**<.01**	.44	.23	.24				
8. Perceived benefits of HPV vaccine against HPV-related cancer										
Correlation	**.20**	.02	−.06	**.59**	.12	.08	.02	–		
p value	**.02**	.80	.50	**<.01**	.17	.34	.80			
9. Anticipated regret if unvaccinated and later developed HPV-related cancer										
Correlation	**.23**	**.24**	.06	.15	**.76**	**.29**	.11	.14	–	
p value	**.01**	**<.01**	.47	.07	**<.01**	**<.01**	.19	.12		
10. Have heard of HPV vaccine[a]										

	1	2	3	4	5	6	7	8	9	10
Correlation	−.14	.13	−.15	.05	.00	**.23**	−.15	.04	.07	–
p value	.11	.12	.09	.53	1.00	**.01**	.09	.67	.45	
Mean	2.15	3.14	2.20	3.04	3.51	3.57	2.10	2.74	3.58	.66
SD	.88	.87	.72	.88	.75	.77	.63	.79	.74	.48

N = 137; HPV: human papillomavirus, SD: standard deviation. Statistics significant at $p < .05$ are denoted in bold

[a]Have heard of HPV vaccine was coded as 0 = no and 1 = yes

Table 3

Intercorrelations and descriptive statistics for study variables among women

	1	2	3	4	5	6	7	8	9	10
1. Intention to ask doctor for HPV vaccine										
Correlation	–									
p value										
2. Perceived severity of genital warts										
Correlation	.03	–								
p value	.78									
3. Perceived risk of genital warts										
Correlation	**.31**	−.03	–							
p value	**.01**	.77								
4. Perceived benefits of HPV vaccine against genital warts										
Correlation	**.23**	−.15	**.29**	–						
p value	**.049**	.19	**.01**							
5. Anticipated regret if unvaccinated and later developed genital warts										
Correlation	**.28**	**.35**	**.25**	**.26**	–					
p value	**.02**	**<.01**	**.03**	**.02**						
6. Perceived severity of HPV-related cancer										
Correlation	−.05	**.66**	−.09	−.06	**.28**	–				
p value	.68	**<.01**	.43	.60	**.02**					
7. Perceived risk of HPV-related cancer										
Correlation	**.29**	−.04	**.79**	.12	.08	−.06	–			
p value	**.01**	.77	**<.01**	.30	.49	.59				
8. Perceived benefits of HPV vaccine against HPV-related cancer										
Correlation	**.41**	−.09	**.35**	**.72**	**.30**	−.04	**.36**	–		
p value	**<.01**	.45	**<.01**	**<.01**	**.01**	.74	**<.01**			
9. Anticipated regret if unvaccinated and later developed HPV-related cancer										
Correlation	.21	**.40**	.16	.19	**.82**	**.43**	.09	.26	–	
p value	.07	**<.01**	.18	.10	**<.01**	**<.01**	.45	.03		
10. Have heard of HPV vaccine[a]										

	1	2	3	4	5	6	7	8	9	10
Correlation	.04	**.31**	−.17	−.08	.13	**.54**	−.09	−.07	.20	–
p value	.76	**.01**	.15	.47	.25	**<.01**	.44	.57	.09	
Mean	2.67	3.29	2.36	2.72	3.28	3.71	2.33	2.75	3.43	.84
SD	1.06	.88	.81	1.00	.90	.61	.69	.77	.77	.37

N = 76; HPV: human papillomavirus, SD: standard deviation. Statistics significant at a $p < .05$ are denoted in bold

[a]Have heard of HPV vaccine was coded as 0 = no and 1 = yes

Table 4

Multiple regression analyses of anticipated regret in relation to Health Belief Model variables

Outcome variable	Independent variables	*B*	R^2	ΔR^2	ΔF	*p* value
Men						
Anticipated regret if unvaccinated and later developed genital warts						
Step 1			<.01	<.01	.13	.72
	Have heard of HPV vaccine[a]	.05				.72
Step 2			**.10**	**.09**	**4.78**	**.01**
	Have heard of HPV vaccine[a]	−.03				.85
	Perceived severity of genital warts	**.24**				**<.01**
	Perceived benefits of HPV vaccine against genital warts	.12				.10
	Perceived risk of genital warts	.01				.90
Anticipated regret if unvaccinated and later developed HPV-related cancer						
Step 1			.01	.01	.94	.34
	Have heard of HPV vaccine[a]	.13				.34
Step 2			**.12**	**.11**	**5.66**	**<.01**
	Have heard of HPV vaccine[a]	.04				.74
	Perceived severity of HPV-related cancer	**.28**				**<.01**
	Perceived benefits of HPV vaccine against HPV-related cancer	.08				.26
	Perceived risk of HPV-related cancer	.15				.10
Women						
Anticipated regret if unvaccinated and later developed genital warts						
Step 1			.02	.02	1.97	.17
	Have heard of HPV vaccine[a]	.37				.17
Step 2			**.26**	**.23**	**8.09**	**<.01**
	Have heard of HPV vaccine[a]	.12				.63
	Perceived severity of genital warts	**.40**				**<.01**
	Perceived benefits of HPV vaccine against genital warts	**.23**				**.02**
	Perceived risk of genital warts	.21				.08
Anticipated regret if unvaccinated and later developed HPV-related cancer						
Step 1			.02	.02	1.64	.20
	Have heard of HPV vaccine[a]	.29				.20
Step 2			**.23**	**.21**	**6.77**	**<.01**
	Have heard of HPV vaccine[a]	−.21				.40
	Perceived severity of HPV-related cancer	**.58**				**<.01**
	Perceived benefits of HPV vaccine against HPV-related cancer	**.25**				**.02**
	Perceived risk of HPV-related cancer	−.01				.94

N for men = 143; *N*s for women = 80–82; HPV: human papillomavirus. Statistics significant at a $p < .05$ are denoted in bold. Standardized beta coefficients are presented

[a]Have heard of HPV vaccine was coded as 0 = no and 1 = yes

Table 5

Multiple regression analyses of HPV vaccine intention in relation to anticipated regret and Health Belief Model variables

Independent variables	*B*	R^2	ΔR^2	ΔF	*p* value
Men					
Step 1		.02	.02	2.49	.12
Have heard of HPV vaccine[a]	−.25				.12
Step 2		**.07**	**.05**	**2.43**	**.048**
Have heard of HPV vaccine[a]	−.24				.14
Perceived severity of genital warts	.06				.51
Perceived benefits of HPV vaccine against genital warts	.16				.07
Perceived risk of genital warts	.20				.07
Step 3		**.10**	**.03**	**4.43**	**.02**
Have heard of HPV vaccine[a]	−.24				.14
Perceived severity of genital warts	.01				.93
Perceived benefits of HPV vaccine against genital warts	.14				.12
Perceived risk of genital warts	.19				.07
Anticipated regret if unvaccinated and later developed genital warts	**.22**				**.04**
Step 1		.02	.02	2.73	.10
Have heard of HPV vaccine[a]	−.26				.10
Step 2		.06	.04	2.08	.07
Have heard of HPV vaccine[a]	−.22				.17
Perceived severity of HPV-related cancer	−.07				.47
Perceived benefits of HPV vaccine against HPV-related cancer	**.20**				**.03**
Perceived risk of HPV-related cancer	.10				.38
Step 3		**.12**	**.05**	**8.13**	**.01**
Have heard of HPV vaccine[a]	−.23				.14
Perceived severity of HPV-related cancer	−.15				.13
Perceived benefits of HPV vaccine against HPV-related cancer	.17				.052
Perceived risk of HPV-related cancer	.06				.62
Anticipated regret if unvaccinated and later developed an HPV-related cancer	**.29**				**.01**
Women					
Step 1		<.01	<.01	.05	.82
Have heard of HPV vaccine[a]	.07				.82
Step 2		.11	.11	3.10	.06
Have heard of HPV vaccine[a]	.16				.62
Perceived severity of genital warts	.04				.78
Perceived benefits of HPV vaccine against genital warts	.16				.18
Perceived risk of genital warts	**.33**				**.03**
Step 3		**.14**	**.03**	**2.27**	**.049**

Independent variables	*B*	R^2	ΔR^2	ΔF	*p* value
Have heard of HPV vaccine[a]	.12				.72
Perceived severity of genital warts	−.05				.74
Perceived benefits of HPV vaccine against genital warts	.11				.37
Perceived risk of genital warts	.28				.06
Anticipated regret if unvaccinated and later developed genital warts	.22				.14
Step 1		<.01	<.01	.19	.67
Have heard of HPV vaccine[a]	.14				.67
Step 2		**.20**	**.20**	**6.07**	**<.01**
Have heard of HPV vaccine[a]	.42				.24
Perceived severity of HPV-related cancer	−.18				.42
Perceived benefits of HPV vaccine against HPV-related cancer	**.49**				**<.01**
Perceived risk of HPV-related cancer	.25				.15
Step 3		**.22**	**.02**	**1.65**	**<.01**
Have heard of HPV vaccine[a]	.45				.21
Perceived severity of HPV-related cancer	−.30				.21
Perceived benefits of HPV vaccine against HPV-related cancer	**.44**				**.01**
Perceived risk of HPV-related cancer	.25				.16
Anticipated regret if unvaccinated and later developed HPV-related cancer	.21				.20

N for men = 142; *N*s for women = 78–80; HPV: human papillomavirus. Statistics significant at a $p < .05$ are denoted in bold. Standardized beta coefficients are presented

[a]Have heard of HPV vaccine was coded as 0 = no and 1 = yes