HHS Public Access

Author manuscript

Clin Nurs Res. Author manuscript; available in PMC 2020 July 01.

Published in final edited form as:

Clin Nurs Res. 2019 July ; 28(6): 708–725. doi:10.1177/1054773817741590.

Does Self-efficacy Mediate the Relationships between Social-Cognitive Factors and Intentions to Receive HPV Vaccination among Young Women?

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Abstract

Drawing upon health behavior change theories, the current study examined whether self-efficacy mediated relationships between social-cognitive factors (i.e., perceived risk, perceived benefits, perceived barriers, perceived severity, and cue to action) and HPV vaccination intentions among college women. Unvaccinated women (n=115) aged 18–25 years attending a Midwestern university completed an anonymous web-based survey assessing study variables. Correlational analyses and mediation analyses were conducted. Self-efficacy mediated relationships between two social-cognitive factors (i.e., perceived barriers to HPV vaccination [indirect effect = −.16, SE = .06, 95% CI = −.31 to −.06] and perceived risk of HPV-related conditions [indirect effect = .16, SE = .09, 95% CI = .01 to .37]) and HPV vaccination intentions, but was unrelated to the other three social-cognitive factors. Based on these findings, future research should test whether increasing self-efficacy through education on risk of HPV-related conditions and reducing barriers to HPV vaccination improves vaccine uptake in college women.

Keywords

HPV vaccination; health beliefs; health behaviors; cancer prevention; self-efficacy

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Declaration of Conflicting Interests: The authors declare that there is no conflict of interest.

Introduction

Human papillomavirus (HPV) is the most common sexually transmitted infection in the United States (Centers for Disease Control and Prevention [CDC], 2015). Most sexually active individuals contract at least one type of HPV during their lifetime (CDC, 2015). College-aged women are at particularly high risk of contracting HPV (Satterwhite et al., 2013; Winer et al., 2003). Indeed, women aged 20–24 had the highest prevalence of the disease (54%) in a national sample of females aged 15 to 59 years (Satterwhite et al., 2013). While some types of HPV cause genital warts, others can cause cervical, anal, vaginal, vulvar, and oropharyngeal cancers (CDC, 2015). HPV vaccination is recommended for both males and females starting in adolescence (CDC, 2015). A bivalent HPV vaccine, which guards against HPV Types 16 and 18, was approved for females ages 9 through 25 in 2009 (U.S. Food and Drug Administration [FDA], 2013). A quadrivalent HPV vaccine, which protects against HPV Types 6, 11, 16, and 18, was approved for females aged 9 through 26 in 2006 and males aged 9 through 26 in 2009 (FDA, 2011). A nonavalent HPV vaccine, which guards against nine strains of the disease, was approved for females ages 9 through 26, boys aged 9 through 15, and males at high risk for contracting the disease through age 26 in 2014 (FDA, 2015). For those not vaccinated between ages 9 and 12, catch-up vaccination is recommended for individuals aged 13 to 26 years, requiring two shots through age 14 and three shots for those aged 15–26 (CDC, 2016).

Background and Rationale

Although vaccination rates have increased in recent years (Schmidt & Parsons, 2014; Thompson et al., 2016), rates of HPV vaccination among young women continue to be suboptimal (Pierre-Victor, Mukherjee, Bahelah, & Madhivanan, 2014; Schmidt & Parsons, 2014; Thompson et al., 2016). A study utilizing National College Health Assessment II 2009–2013 survey data found that 69% of female college students had received at least one dose of the vaccine by 2013 (Thompson et al., 2016). However, rates of completion of the three shot series among young women have varied across studies from 21% to 50% (Daniel-Ulloa, Gilbert, & Parker, 2016; Rahman, Islam, & Berenson, 2015; Richards, Peters, & Sheeder, 2016; Wilson et al., 2016). Demographic predictors of HPV vaccination among young women have included younger age, single marital status, White race, having private insurance, having a usual healthcare provider (HCP), and having a 12^{th} grade education or higher (Schmidt & Parsons, 2014; Thompson et al., 2016).

Social-cognitive variables have also been examined in relation to HPV vaccination uptake and intentions among young women. The Health Belief Model (HBM), which has frequently been used to study HPV vaccination intentions and behaviors (Bennett, Buchanan, & Adams, 2012; Donadiki et al., 2014; Gerend & Shepherd, 2012; Krawczyk et al., 2012; Schaefer Ziemer & Hoffman, 2013), features multiple predictors of health behaviors, including perceived disease risk, perceived severity of the disease, perceived benefits of the health behavior, perceived barriers to performing the behavior, and cues to action such as HCP recommendation (Champion & Skinner, 2008; Janz & Becker, 1984). In addition, the construct of self-efficacy, or confidence in one’s ability to perform a health behavior, was later added to the HBM and is included in other widely used health behavior theories such as

the Theory of Planned Behavior (TPB) (Ajzen, 1991; Champion & Skinner, 2008; Rosenstock, Strecher, & Becker, 1988).

Self-efficacy may be especially relevant when considering young women's intentions to receive the HPV vaccine due to the multiple steps needed to complete vaccination (e.g., obtaining three shots over the course of six months). However, limited research has studied the role of self-efficacy in HPV vaccination intentions and behaviors among young women (Bennett et al., 2012; Gerend & Shepherd, 2012; Schaefer Ziemer & Hoffman, 2013). For example, drawing upon the HBM and TPB, one study of female college students found that HPV vaccine intentions were positively associated with self-efficacy, perceived risk of HPV, perceived benefits of the vaccine, positive attitudes about the vaccine, and subjective norms (Bennett et al., 2012). However, in a multivariate analysis for the same study, only perceived risk of HPV, attitudes about the vaccine, and subjective norms predicted HPV vaccination intentions (Bennett et al., 2012). Another study of young women found that self-efficacy, subjective norms, perceived risk, perceived severity, and the barrier of safety concerns predicted HPV vaccination intentions; in contrast, only self-efficacy and subjective norms independently predicted vaccine uptake when examining a range of HBM and TPB constructs (Gerend & Shepherd, 2012). A third study found that vaccinated young women had higher levels of self-efficacy for HPV vaccination, subjective norms, perceived benefits, and cues to action as well as lower perceived barriers compared to unvaccinated young women (Schaefer Ziemer & Hoffman, 2013). Thus, preliminary evidence suggests that self-efficacy may play a role in young women's vaccine intentions and uptake.

Purpose of the Study

Drawing upon HBM and TPB theories (Ajzen, 1991; Champion & Skinner, 2008; Janz & Becker, 1984; Rosenstock et al., 1988), researchers have hypothesized that self-efficacy may mediate relationships between key social-cognitive factors and vaccine intentions (Gerend & Shepherd, 2012); however, this hypothesis has yet to be fully examined in any population. One prior study of young women found that self-efficacy mediated the relationship between cue to action and HPV vaccine uptake (Gerend & Shepherd, 2012). However, this was the only examined mediation model (Gerend & Shepherd, 2012). Evidence of mediation would suggest that self-efficacy may be an important target for theory-based interventions promoting HPV vaccination. Self-efficacy has been successfully targeted in other health behavior change interventions for young adults, including interventions to reduce HIV risk behaviors (Calloway, Long-White, & Corbin, 2014), increase dairy intake (Poddar, Hosig, Anderson, Nickols-Richardson, & Duncan 2010), and reduce alcohol risk behaviors (Bock et al., 2016).

The current study examines the role of self-efficacy in HPV vaccine intentions of young undergraduate women. Given their risk for HPV infection and their ability to make vaccine decisions themselves, it is important to understand HPV vaccination beliefs and behaviors among this population (Satterwhite et al., 2013; Winer et al., 2003). Based on HBM and TPB frameworks (Ajzen, 1991; Champion & Skinner, 2008; Janz & Becker, 1984; Rosenstock et al., 1988), we hypothesized that self-efficacy for HPV vaccination would mediate relationships between five social-cognitive factors (i.e., perceived risk of HPV-

related conditions, perceived benefits of the vaccine, perceived barriers to vaccination, perceived severity of HPV-related conditions, cue to action) and intention to receive the HPV vaccine.

Methods

Design and Sample

Study methods for this cross-sectional study have been described previously (Winger et al., 2015). Briefly, undergraduate students were recruited from a psychology department research pool at a Midwestern university following Indiana University Institutional Review Board approval (IRB# 1208009286). Eligible students were between 18 and 32 years of age and fluent in English. This age range was selected because the HPV vaccine was approved for individuals up to 26 years of age about six years prior to study data collection (FDA, 2011, 2013). The larger study enrolled both vaccinated and unvaccinated men and women. However, for this current study, only data from unvaccinated female participants ages 18–26 (n=115) were used. This age group was selected as the study outcome was intentions to receive the vaccine. Verbal informed consent was obtained from all individual participants included in the study. Following informed consent, participants completed a 30-minute anonymous, web-based survey in a campus classroom and received course credit for their participation. Computers were spaced adequately in the room to protect the students' privacy.

Measures

Intentions to receive the HPV vaccine.—Intentions were assessed with a single item regarding the likelihood of receiving the HPV vaccine (i.e., "How likely is it that you'll actually get the HPV vaccine?") that has been used in previous studies with young women (Gerend & Shepherd, 2007, 2012; Gerend, Shepherd, & Monday, 2008; Gerend, Shepherd, & Lustria, 2013). Participants responded on a 7-point scale from 1="very unlikely" to 7="very likely."

Self-efficacy.—Three items assessed self-efficacy or one's perceived ability to receive the vaccine even if: 1) it was expensive, 2) it hurt, or 3) one had to find the time to go to the doctor three times (Gerend & Shepherd, 2012). Items were rated on a 7-point scale from 1="disagree strongly" to 7="agree strongly" and averaged to compute a total score. Cronbach's alpha in the current study was .82.

Perceived risk.—Four items assessed participants' perceived risk of developing each of four HPV-related conditions (i.e., genital warts, anal cancer, oral cancer, and cervical cancer) (Brewer, Ng, McRee, & Reiter, 2010; Reiter, Brewer, McRee, Gilbert, & Smith, 2010). Items were rated on a 5-point scale from 1="no chance" to 5="certain I will get [the condition]" and averaged to compute a total score. Cronbach's alpha in the current study was .92.

Perceived benefits.—Four items assessed the perceived benefits of HPV vaccination or the degree to which the vaccine would provide protection against each of the four HPV-

related conditions (Brewer et al., 2010; Reiter et al., 2010). Items were rated on a 5-point scale from 1="no protection" to 5="complete protection" and averaged to compute a total score. Cronbach's alpha in the current study was .83.

Perceived barriers.—Two items assessed perceived barriers to vaccination, or the degree to which concerns about side effects or the safety of the vaccine would prevent them from receiving it (Gerend & Shepherd, 2012). Items were rated on a 7-point scale from 1="disagree strongly" to 7="agree strongly" and averaged to compute a total score. Cronbach's alpha in the current study was .83.

Perceived severity.—Four items assessed the perceived severity of the four HPV-related conditions or the degree to which participants believed their lives would be affected by each of the conditions (Brewer et al., 2010; Reiter et al., 2010). Items were rated on a 4-point scale from 1="not at all" to 4="quite a lot" and averaged to compute a total score. Cronbach's alpha in the current study was .80.

Cue to action.—Cue to action was assessed with one item. Participants responded either "yes" or "no" to the question "has a doctor or other health professional ever recommended that you get the HPV vaccination?" (Jain et al., 2009).

Prior awareness of the HPV vaccine.—Participants responded to a single item (coded "yes" or "no") regarding whether they had previously heard of the HPV vaccine.

Demographics, healthcare, and sexual experience.—Participants reported their demographic information and indicated whether they had a regular HCP and the number of times they had visited a primary care provider in the past 12 months, not including emergency care. Participants also reported whether they had ever engaged in sexual intercourse (defined as vaginal, anal, or oral sex), and whether they had been told by a HCP that they had HPV.

Data Analyses

Statistical analyses were conducted using SPSS version 21.0. Only data from women who had not received the HPV vaccine and were age 26 or younger were included in study analyses. Data from 66 men, 165 women who had received the vaccine, and 4 individuals who did not provide their gender were excluded from study analyses. In addition, data from 3 unvaccinated women who did not report their age and 3 unvaccinated women who were greater than 26 years of age were excluded from analyses (FDA, 2011, 2013).

First, correlational analyses were conducted to examine associations between the main study variables and intentions to receive the HPV vaccine. Next, five separate mediation analyses were conducted using the PROCESS SPSS macro (Model 4) to test the hypothesis that self-efficacy would mediate relationships between five social-cognitive variables (i.e., perceived risk, perceived benefits, perceived barriers, perceived severity, cue to action) and HPV vaccine intentions. Each analysis controlled for the four unexamined HBM variables as well as prior awareness of the HPV vaccine. Bootstrapping with 5,000 resamples was used for all

mediation analyses, and bias-corrected bootstrap confidence intervals are reported (Hayes, 2009, 2013; Preacher & Hayes, 2008).

Results

Sample Characteristics

Sample characteristics are presented in Table 1. Briefly, participants (n = 115) were unvaccinated college women between 18 and 25 years of age (M = 19.28; SD=1.66). Participants reported the following racial backgrounds: White (77%), Black (12%), and other/more than one race (8%). Most participants self-identified as heterosexual (90%). Although the majority (74%) reported having visited a HCP at least once in the past year and 54% reported having a regular HCP, only 38% reported that a HCP had recommended the HPV vaccine. Additionally, 81% of participants had previously heard of the HPV vaccine. Seventy-five percent of participants reported a prior sexual experience, and only two participants (<2%) reported a prior diagnosis of HPV.

Preliminary Analyses

Correlations between the main study variables are shown in Table 2. Self-efficacy for HPV vaccination was positively associated with intentions to receive the HPV vaccine, whereas perceived barriers to vaccination were negatively associated with intentions. Perceived risk of HPV-related conditions was positively associated with self-efficacy, whereas perceived barriers were negatively associated with self-efficacy. Receiving a HCP's recommendation for the vaccine was positively associated with prior awareness of the vaccine. None of the other variables were significantly related.

Self-efficacy as a Mediator of the Relations between Social-cognitive Factors and Intentions

First, self-efficacy was examined as a potential mediator of the relationship between perceived risk of developing HPV-related conditions and HPV vaccine intentions. As hypothesized, there was a significant indirect effect of perceived risk on intentions through self-efficacy (indirect effect = .16, SE = .09, 95% CI = .01 to .37; see Figure 1). In this model, perceived risk of developing HPV-related conditions was positively associated with self-efficacy for HPV vaccination which, in turn, was positively associated with intentions to receive the vaccine. A second mediation model examined whether self-efficacy mediated the relationship between perceived barriers to HPV vaccination and vaccine intentions. As hypothesized, there was a significant indirect effect of perceived barriers on intentions through self-efficacy (indirect effect = −.16, SE = .06, 95% CI = −.31 to −.06; see Figure 2). Specifically, perceived barriers to HPV vaccination were negatively associated with self-efficacy for vaccination which, in turn, was positively associated with intention to receive the vaccine. Three additional models examined whether self-efficacy mediated the effects of perceived benefits of the HPV vaccine, perceived severity of HPV-related conditions, and cue to action on vaccine intentions. Contrary to hypotheses, none of these indirect effects were found to be significant, including indirect effects of perceived benefits (indirect effect = −.07, SE = .09, 95% CI = −.27 to .09), perceived severity (indirect effect = −.08, SE = .12,

95% CI = −.36 to .13), and cue to action (indirect effect = −.07, SE = .14, 95% CI = −.37 to .18).

Discussion

This study provides an initial examination of a key theory-driven hypothesis—the proposed mediational role of self-efficacy in relationships between other social-cognitive factors and HPV vaccination intentions. These analyses were applied to young women, a population at high risk of HPV (Satterwhite et al., 2013; Winer et al., 2003). In the current study, self-efficacy for HPV vaccination helped explain the relationship between perceived risk of HPV-related conditions and vaccine intentions. Specifically, perceived risk was positively associated with self-efficacy, which in turn, was positively associated with vaccine intentions. In addition, self-efficacy accounted for the negative relationship between perceived barriers to vaccination and intentions. Specifically, perceived barriers were negatively associated with self-efficacy, which, in turn, was positively associated with intentions to receive the HPV vaccine. Thus, results support aspects of the HBM and TPB frameworks (Ajzen, 1991; Champion & Skinner, 2008; Janz & Becker, 1984; Rosenstock et al., 1988) and suggest that HPV vaccine promotion efforts for young women may target self-efficacy by increasing perceived risk for HPV-related conditions and reducing perceived barriers to vaccination.

Contrary to hypotheses, self-efficacy for HPV vaccination did not account for the relationship between three other social-cognitive factors (i.e., perceived benefits of the vaccine, perceived severity of HPV-related conditions, and cue to action) and vaccine intentions. Furthermore, these three social-cognitive factors were unrelated to self-efficacy and HPV vaccine intentions in univariate analyses. Similarly, a prior study of young women found that self-efficacy and perceived risk predicted HPV vaccine intentions, whereas perceived severity and cues to action failed to do so (Bennett et al., 2012). Null findings for perceived severity in the current study and some prior studies (Bennett et al., 2012; Christy et al., 2016) may have been due to range restriction, as most participants perceived HPV-related conditions (i.e., genital warts, HPV-related cancers) to be very severe. Regarding cue to action, HCP recommendation has generally been found to predict HPV vaccine behaviors among female college students (Krawczyk et al., 2012; Marchand et al., 2012; Wilson et al., 2016), whereas the present study examined whether this recommendation was associated with vaccine intentions. Our findings suggest that HCP recommendation alone does not necessarily lead to increased self-efficacy for vaccination or vaccine intentions among college women. This may be due to significant barriers to vaccination, such as the multiple steps involved, vaccine costs, denial of personal risk of HPV, and concerns about pain and other side effects of the vaccine. Additionally, the null association between perceived benefits and HPV vaccine intentions in this study is inconsistent with prior findings with young women (Bennett et al., 2012; Christy et al., 2016). Although the HPV vaccine had been available for multiple years (FDA, 2011, 2013), the young women in the current study were all unvaccinated. Thus, for these women, the benefits of vaccination may have been less important than other factors in their decision-making process. Of note, there was a weak, positive correlation between perceived benefits and intentions that was non-significant.

Efficacious interventions to promote HPV vaccination among young women are needed, as few interventions have shown preliminary evidence of efficacy and trials have been limited by small sample sizes, a lack of control groups, or unequal intervention dosages across study conditions (Bennett et al., 2015; Gerend & Shepherd, 2007; Hopfer, 2012; Kester, Shedd-Steele, Dotson-Roberts, Smith, & Zimet 2014; Lee, Koopmeiners, McHugh, Raveis, & Ahluwalia 2016; Perez, Cruess, & Strauss,2016). To date, only one HPV vaccine promotion trial has examined self-efficacy as the mechanism through which the intervention may have successfully promoted vaccination (Hopfer, 2012). Conducted among college women, this intervention study included four study arms: peer narration, medical provider narration, a combination of peer and medical provider narration, and a control group (Hopfer, 2012). Only the arm which included both peer and medical provider narration demonstrated success in improving vaccination, and this was achieved through increases in self-efficacy and intention (Hopfer, 2012). Consistent with our findings, the authors of this trial reasoned that the peer and medical provider narratives may have increased college women's self-efficacy by providing ideas for overcoming barriers and improving awareness of the HPV vaccine (Hopfer, 2012).

Prior educational intervention trials to improve HPV vaccination among young women have included multiple modalities (i.e., peer and medical expert narrative videos (Hopfer, 2012), small group discussions (Kester et al., 2014), text message (Lee et al., 2016), and computer-based interventions (Bennett et al., 2015; Paiva, Lipschitz, Fernandez, Redding, & Prochaska 2014)). Unfortunately, providing HPV education through these interventions, even when successful in improving knowledge, has often failed to promote HPV vaccine intention and uptake (Bennett et al., 2015; Perez et al., 2016). Similarly, in a prior cross-sectional study, HPV vaccine knowledge was unrelated to HPV vaccine intentions and uptake among young women (Ratanasiripong, Cheng, & Enriquez, 2013). Thus, future interventions need to move beyond the sole aim of improving knowledge.

Application

This study sets the stage for intervention research that directly informs nursing practice. Specifically, future vaccine promotion studies with young women may test whether self-efficacy for HPV vaccination might be targeted through increasing perceived risk and reducing barriers to vaccination (Hopfer, 2012; Kahn et al., 2008). Strategies to be tested in future interventions may include pragmatic information about overcoming perceived barriers; for example, among college women, this may include information on student health center hours and location. Among all women, strategies could include scheduling appointments for vaccine doses ahead of time and providing information on insurance coverage for HPV vaccination. Additional intervention strategies warranting examination include viewing a video-based testimonial from a young women on HPV risk and the easy process of vaccination as well as a testimonial from a nurse or other HCP regarding risk information and vaccine safety and efficacy.

Limitations and Future Directions

Several study limitations and directions for future research should be noted. This study is cross-sectional and, thus, temporal relationships cannot be determined. Longitudinal studies

are needed to examine changes in self-efficacy as predictors of HPV vaccine intentions and uptake. Additionally, the participants were primarily White women and were college students from a Midwestern institution; the extent to which findings replicate in diverse samples of college students, including college men, and young adults who do not attend college warrants attention. Finally, future research may draw upon the HBM and TPB to include other constructs not examined in the current study. For example, knowledge of HPV risk factors or prevalence, alternative cues to action (e.g., recommendations from friends and family members, exposure to media campaigns), and subjective norms for vaccination may be studied in relation to self-efficacy and HPV vaccine intentions and behaviors.

Conclusions

Despite young women's high risk for HPV, highly efficacious vaccine promotion interventions have yet to be developed for this population. Interventions are needed which not only increase vaccine awareness, but enhance self-efficacy for completing the three-shot vaccine series. Our results suggest that self-efficacy might be improved by reducing barriers to vaccination and increasing perceptions of risk for HPV-related conditions. Efforts to optimize HPV vaccine promotion strategies are needed in order to decrease morbidity and mortality from HPV-related cancers.

Acknowledgements:

A portion of the study results were presented at the 2017 Society of Behavioral Medicine annual meeting and the abstract was published in a supplemental issue of *Annals of Behavioral Medicine*. The authors would like to thank Leah Van Antwerp for her assistance with data collection.

Funding acknowledgements: The work of the first author was previously funded (during study design and data collection) by R25CA117865 (V.L. Champion, PI) and is currently funded (during data analyses and manuscript preparation) by R25CA090314 (T.H. Brandon, 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.E. Mosher, PI) and K05CA175048 (V.L. Champion, PI) from the National Cancer Institute. The funding sources had no involvement in the study design, data collection, data analysis, interpretation of the data, writing of the manuscript, or the decision to submit the manuscript for publication. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Cancer Institute.

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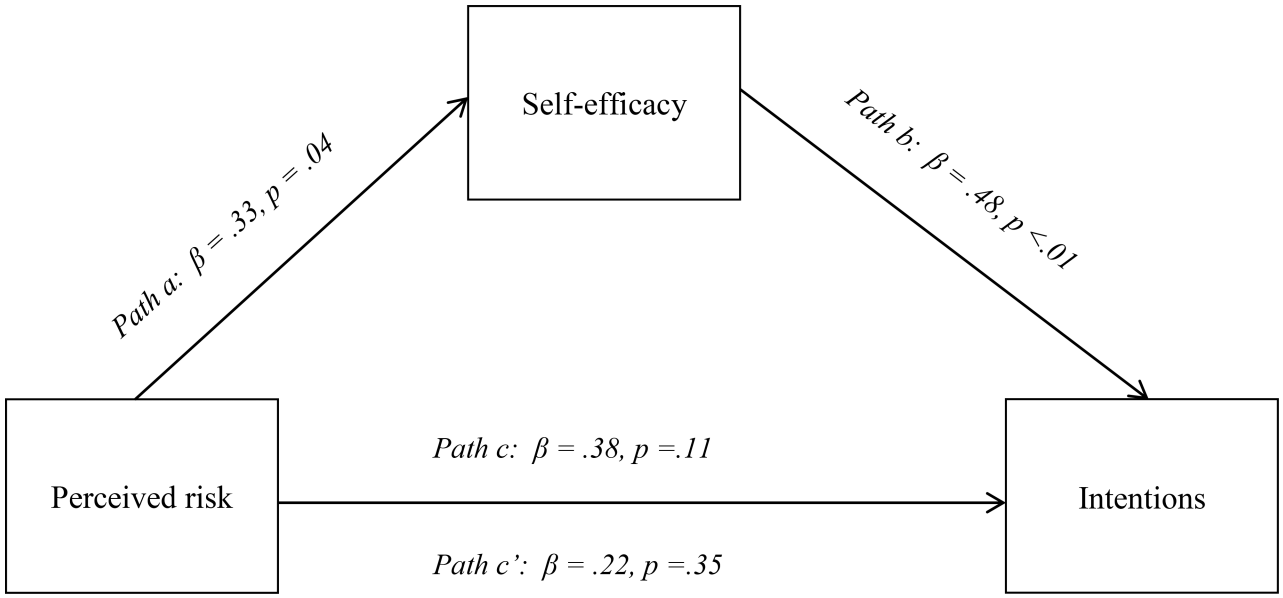

Figure 1. Self-efficacy mediates the relationship between perceived risk of HPV-related conditions and HPV vaccine intentions.

Note. Coefficients are unstandardized. Analyses controlled for the following variables: perceived barriers, perceived benefits, perceived severity, cue to action, and prior awareness of the HPV vaccine.

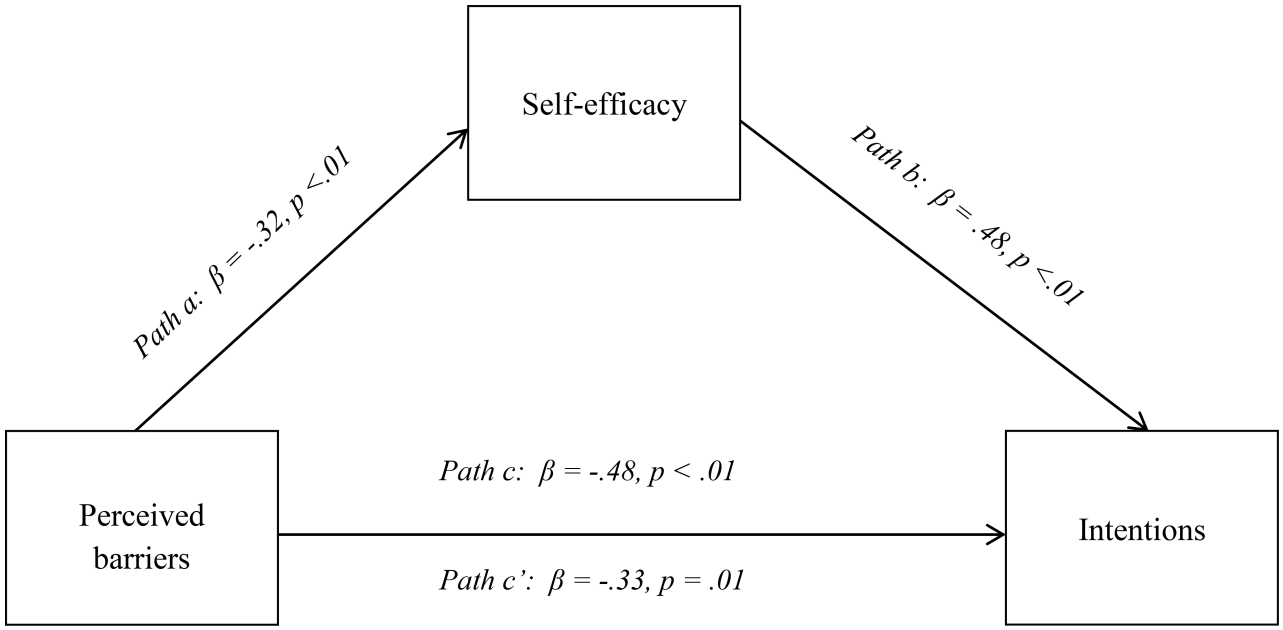

Figure 2. Self-efficacy mediates the relationship between perceived barriers to HPV vaccination and HPV vaccine intentions.

Note. Coefficients are unstandardized. Analyses controlled for the following variables: perceived risk, perceived benefits, perceived severity, cue to action, and prior awareness of the HPV vaccine.

Table 1

Sample characteristics (N = 115)

Variables		***N (%)***
Age	18–19	86 (75)
	20–21	17 (15)
	22–23	6 (5)
	24–25	6 (5)
Race/Ethnicity	White	89 (77)
	African-American/Black	14 (12)
	Other/More than one race	9 (8)
	Missing	3 (3)
Sexual Orientation	Gay/Homosexual	1 (1)
	Bisexual	4 (4)
	Heterosexual	104 (90)
	Other/Not sure	5 (4)
	Missing	1 (1)
Health Insurance	Yes	96 (84)
	No	19 (17)
Number of HCP Visits in Past 12 Months	1+	85 (74)
	None	30 (26)
Regular HCP Yes	No	62 (54)
		53 (46)
Prior HPV Diagnosis	Yes	2 (2)
	No	113 (98)
Have Had at Least One	Yes	86 (75)
Sexual Experience	No	29 (25)
Had Previously Heard of HPV Vaccine	Yes	93 (81)
	No	22 (19)
HCP Had Recommended HPV Vaccine	Yes	44 (38)
	No	71 (62)

Note. HCP = health care professional, HPV = human papillomavirus.

Totals may not add to 100% due to rounding.

Table 2

Correlations between study variables

		1	2	3	4	5	6	7	8
1. Intention to receive the HPV vaccine	Corr.	-							
	Sig.								
2. Self-efficacy	Corr.	**.41**	-						
	Sig.	**<.01**							
3. Perceived risk	Corr.	.16	**.21**	-					
	Sig.	.09	**.03**						
4. Perceived benefits	Corr.	.14	−.03	.06	-				
	Sig.	.13	.74	.50					
5. Perceived barriers	Corr.	**−.35**	**−.34**	−.06	−.07	-			
	Sig.	**<.01**	**<.01**	.50	.45				
6. Perceived severity	Corr.	−.07	−.10	−.01	−.11	.13	-		
	Sig.	.43	.27	.94	.25	.18			
7. Cue to action[1]	Corr.	.06	−.08	−.11	−.10	.03	.09	-	
	Sig.	.53	.40	.25	.28	.77	.35		
8. Prior awareness of the HPV vaccine[2]	Corr.	−.03	−.04	.16	−.15	.12	.17	**.38**	-
	Sig.	.79	.69	.09	.11	.19	.07	**<.01**	
	Mean	3.49	4.73	2.19	2.71	5.53	3.67	.38	.81
	SD	2.01	1.36	.77	.76	1.38	.50	.49	.40

Note. *N*=115. Corr. = Pearson's correlation; Sig.=significance; SD=standard deviation. Significant results are bolded.

[1]Cue to action was defined as receiving a health care provider recommendation for the HPV vaccine and was coded as 0=no and 1=yes.

[2]Prior awareness of the HPV vaccine was coded as 0=no and 1=yes.