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Does framing HPV vaccine as preventing cancer in men increase vaccine acceptability?

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Abstract

Background—Human papillomavirus (HPV) vaccine is now approved for use in males in the United States to prevent genital warts. We conducted an experiment to see whether framing HPV vaccination as also preventing cancer in men would increase men’s vaccination willingness.

Methods—We conducted an online survey in January 2009 with a national sample of men aged 18–59 who self-identified as gay/bisexual (n=312) or heterosexual (n=296). In the within-subjects experiment, men read 4 randomly ordered vignettes that described hypothetical vaccines that prevented either genital warts alone, or genital warts and either anal cancer, oral cancer, or penile cancer. We analyzed data using repeated-measures analysis of variance and tested whether perceived severity or perceived likelihood mediated the effect of disease outcome framing on men’s HPV vaccination willingness

Results—While only 42% of men were willing to receive HPV vaccine when it was framed as preventing genital warts alone, 60% were willing to get it when it was framed as preventing cancer in addition to genital warts ($p < .001$). The effect of outcome framing was the same for heterosexual and gay/bisexual men and for the three cancer types examined. Perceived severity of disease partially mediated the association between disease outcome and HPV vaccination willingness.

Conclusions—Men may be more accepting of HPV vaccine when it is framed as preventing cancer, regardless which of the three most common HPV-related cancers in men is described.

Impact—Study findings may be useful in developing health communication messages that maximize HPV vaccine acceptability among young men.

Keywords

HPV; Vaccine acceptability; Vaccination; Cancer

Human papillomavirus (HPV) vaccine is now recommended for males. The United States Food and Drug Administration (FDA) approved quadrivalent HPV vaccine (HPV4) for males aged 9 to 26 in October 2009 (1), and the Advisory Committee on Immunization Practices (ACIP) made a provisional permissive recommendation for this group soon after (2). HPV4’s indication is for genital wart prevention in males, but it is also indicated for females is to prevent cervical cancer as well as genital warts (3). Indeed, a common lay term

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for HPV4 is “the cervical cancer vaccine”. While HPV4 can prevent two viral types that cause genital warts in men, it also prevents two other oncogenic HPV types that can cause oral, anal, and penile cancers in men (4–6). Preliminary data from trials examining HPV4 in men are promising enough that some types of cancer could one day be included as an indication for men (7). Bivalent HPV vaccine (HPV2) does not offer protection against HPV types associated with genital warts and is not currently licensed for use in males in the United States (8).

How might the added benefit of preventing cancer affect men’s interest in HPV4? Studies have found that some ways of framing HPV vaccination messages make HPV vaccine more acceptable to women (9–11). Discussing cancer prevention seems to be especially important. The findings for men have been less clear. Studies have found that being able to protect their female sexual partners from cervical cancer does not increase HPV vaccine acceptability among men (12), and that vaccine acceptability is lower when framed as preventing cervical cancer in their sexual partners alone as compared to preventing both cervical cancer and genital warts (13). However, no published study has examined the impact of outcome framing on HPV vaccine acceptability in males using diseases that affect their own health, as opposed to only their partners’ health.

Perceived relevance may make message frames more effective for some men than others (9,14,15). Messages about penile cancer may be more attention grabbing for men than other cancers, such as oral cancer. Messages about anal cancer could be particularly important to gay and bisexual men, who have higher rates of HPV and an increased risk of anal cancer compared to the general population (16,17). In contrast, messages about anal cancer may be off-putting to some heterosexual men, because of stereotypes that link gay men and anal sex (18).

Another question concerns the process through which message frames might affect interest in HPV vaccine (i.e., mediation). Potential mediators include perceived disease likelihood and severity, which health behavior theories suggest guide health decisions (19). Cancers should be seen as both less common and more severe than genital warts, and these beliefs should in turn affect acceptability.

The purpose of this study was to explore the relationship of disease outcome framing and sexual orientation on HPV vaccination willingness among a national sample of men, including gay and bisexual men. We tested the hypotheses that: 1) framing HPV vaccine as preventing cancer increases men’s vaccination willingness, 2) penile cancer is more motivating than other cancers (regardless of sexual orientation), 3) anal cancer is more motivating than other cancers cancer for gay men, and 4) higher perceived severity and higher perceived likelihood of HPV-related disease would mediate the association between outcome framing and men’s HPV vaccination willingness.

Materials and Methods

Study Design

The University of North Carolina Men's Health Survey examined men's beliefs about HPV vaccine and HPV-related cancers, one component of which collected data to address our hypotheses. In January 2009, about ten months before the FDA approved HPV4 for men, we interviewed men aged 18–59 years who were members of a nationally representative panel of U.S. households maintained by the survey company, Knowledge Networks (Menlo Park, CA). The survey company recruits panel members using list-assisted random-digit dialing, which provides a probability-based sample of households with telephones (20). Upon recruitment into the panel, the company collects extensive demographic information,

including self-reported sexual orientation. Once sampled for a specific survey, panel members receive a notification email containing a link to the study description and consent to take the survey. Households containing one or more panel members receive free internet access in exchange for panel members completing multiple internet-based surveys each month. Panel members in households with existing computer and internet access accumulate points as they complete surveys, which can then be redeemed for small cash payments at regular intervals. The Institutional Review Board at the University of North Carolina approved the study.

Our study used a stratified sampling approach, oversampling men who self-identified as either gay or bisexual. Of 874 men we invited to participate, 609 (70%) completed the online survey, about half of whom reported being gay or bisexual (51%, 312/609)(21). Compared to non-respondents, respondents were more likely to be older, non-Hispanic white, have a college degree, and have household incomes of at least \$60,000 (all $p<.05$) but they were equally likely to have a spouse or be living with a partner ($p=.18$). In analyses, we excluded data from one heterosexual respondent who reported receiving HPV vaccine prior to the survey, resulting in an analytic sample of 608 men who had not yet been vaccinated against HPV. Respondents' mean age was 44 years ($SD= 10$). Most respondents were non-Hispanic White (79%; Table 1), did not have a college degree (55%), reported an annual household income of at least \$60,000 (55%), and lived in an urban area (88%). Compared to heterosexual respondents, gay and bisexual respondents were more likely to be older, have a college degree, report a higher household income, live in an urban area, and not live with a partner or spouse (all $p<.05$). We describe differences by sexual orientation for the study population in detail elsewhere (21).

Measures

The University of North Carolina Men's Health Survey is available online at www.unc.edu/~ntbrewer/hpv.htm. We developed survey items based on our previous HPV vaccine research involving females, parents, and healthcare providers (22–24). We cognitively tested the survey with 36 gay, bisexual, and heterosexual men to ensure item clarity and refine measures.

HPV vaccination willingness—The survey asked men to imagine that HPV vaccine was approved for males and required three doses over a six-month period, and then presented four randomly ordered vignettes that described HPV vaccine as hypothetically preventing: genital warts alone, genital warts and anal cancer, genital warts and oral cancer, or genital warts and penile cancer. For each scenario, men indicated their willingness to get HPV vaccine. Response options were “definitely not willing,” “probably not willing,” “not sure,” “probably willing,” and “definitely willing.” While our main analyses examined HPV vaccine acceptability as a continuous variable (coded as 1–5), we also classified each participant as either “willing” (responded probably or definitely willing on a majority of items) or “not willing” to get HPV vaccine to describe some findings.

Perceived severity and likelihood—The survey assessed perceived severity and perceived likelihood of getting each of three HPV-related diseases (genital warts, oral cancer, and anal cancer). The perceived severity questions read, “How much do you think having [disease] would affect your life?” Response options ranged from “not at all” to “quite a lot” (coded as 1–4, $\alpha=.71$). Perceived likelihood questions read, “Without the HPV vaccine, what do you think is the chance that you will get [disease] in the future?” Response options ranged from “no chance” to “certain I will get [disease]” (coded as 1–5, $\alpha=.84$).

The survey also assessed socio-demographic characteristics, including men's sexual orientation, age, race/ethnicity, education, household income, relationship status and area of residence. We defined "urban" as living in a metropolitan statistical area (MSA) and "rural" as living outside of an MSA (25).

Data Analysis

We examined mean differences in willingness using a 4×2 repeated measures analysis of variance (ANOVA) for mixed designs to explore the influence of disease outcome framing (within subjects, 4 levels) and sexual orientation (between subjects, 2 levels). Because the survey assessed perceived likelihood and severity of three diseases (but not penile cancer), we analyzed these data with a 3×2 mixed repeated measures design that was otherwise the same as the analysis for willingness. Post-hoc contrasts compared genital warts-only framing to the remaining cancer-containing frames, and assessed differences among the cancer frames. We adjusted *p* values for post-hoc tests using Bonferroni corrections. As exploratory analyses found that controlling for demographic variables associated with sexual orientation did not affect our main findings, we did not control for them in the analysis. Given a sample size of $n=600$ and a two-sided alpha level of .05, the study had 80% power to detect relatively small mean differences in both within subjects ($d=.11$) and between subjects analyses ($d=.23$)(26).

We tested mediation with methods described by Baron and Kenny (27), using the ANOVA analyses described above to determine if there was an effect of disease outcome framing on men's HPV vaccination willingness to be mediated and whether perceived severity or perceived likelihood were candidates for mediating the effect. We then ran generalized estimating equation models that controlled for sexual orientation and conducted Sobel's test (28) to determine whether the change in effect due to the hypothesized mediator was significant. We conducted ANOVAs in SPSS version 16.0 (SPSS, Inc, Chicago, IL) and mediation analyses in SAS version 9.1 (SAS Institute, Inc., Cary, NC). Tests of significance were two-tailed with a critical alpha of .05.

Results

We organize our results by first presenting the primary outcome (HPV vaccination willingness), and then presenting the potential mediators (perceived severity and perceived likelihood). Within each section, we report the effects of disease outcome framing, sexual orientation and then their interaction. We conclude with the mediation analyses.

HPV vaccination willingness

Men were moderately willing to be vaccinated against HPV (mean= 3.55, SD= 1.20). Overall, 55% of men (336/608) were willing to be vaccinated against HPV (responded probably or definitely willing to any 3 of the 4 willingness items). In initial analyses, men's vaccination willingness differed by disease (Figure 1) [$F(3, 1818)= 148, p<.001$], so we conducted post-hoc contrasts to explore the pattern of difference. These comparisons indicated that framing HPV vaccine as preventing both genital warts and any of the cancers led to greater willingness to be vaccinated against HPV than framing the vaccine as preventing genital warts alone [$F(1, 607)= 234, p<.001$]. In the cancer plus genital warts outcome conditions, 60% were willing to receive HPV vaccine, whereas 42% were willing to receive the vaccine described as preventing only genital warts. Willingness in the three cancer outcome conditions did not differ ($p=.56$).

Gay and bisexual men were more interested in HPV vaccination than heterosexual men [$F(1, 606)= 207, p<.001$]. Overall, 37% of heterosexual men and 73% of gay and bisexual

men were willing to be vaccinated against HPV. Sexual orientation did not interact with disease outcome frame ($p=.23$), indicating that framing had the same impact on vaccination willingness regardless of sexual orientation.

Mediators

Perceived severity—While men perceived HPV-related disease to be severe (overall mean=3.29, SD=.69), perceived severity differed by disease (Figure 2) [$F(2,1212)= 212, p<.001$]. Post-hoc comparisons indicated that men viewed genital warts as less severe than either anal or oral cancer ($p<.001$), but they perceived anal cancer and oral cancer to be equally severe ($p=.09$). Men's sexual orientation was not associated with their perceived severity ratings [$F(1, 606)= 2, p=.13$]. Disease outcome framing had the same impact on perceived severity of HPV-related disease for both heterosexual and gay/bisexual men as evidenced by the lack of an interaction between sexual orientation and disease type ($p=.35$).

Perceived likelihood—Men perceived relatively low likelihood of getting HPV-related disease (mean=2.07, SD=.63). Men's perceived likelihood differed marginally by disease type (Figure 3), but these differences were quite small [$F(2, 1212)= 2.94, p=.053$]. Gay and bisexual men perceived a greater likelihood of HPV-related disease than heterosexual men [$F(1, 606)= 47, p<.001$]. The interaction of disease type and sexual orientation was statistically significant [$F(2, 1212)= 4, p=.01$]. Post-hoc analyses of the interaction stratified by sexual orientation found no differences in gay and bisexual men's perceived likelihood of the different diseases ($p=.18$). However, heterosexual men perceived greater likelihood of getting oral cancer than getting either genital warts ($p=.02$) or anal cancer ($p<.001$).

Mediation Analysis

We sought to explain the effect of disease outcome framing on HPV vaccine willingness. Perceived severity was a candidate mediator of this association, because it was associated with disease outcome framing and showed the same pattern of findings as willingness (difference between genital warts and cancers, no difference among the cancers, and no interaction with sexual orientation). Perceived likelihood was not a suitable candidate mediator of this association, because it showed a different pattern of findings than willingness (slight difference between genital warts and cancers and an interaction with sexual orientation) (27).

Figure 4 summarizes the analyses of whether perceived severity mediated the association between disease type (genital warts vs. cancer-containing outcome frames) and men's vaccination willingness. As found in the previous ANOVA analyses, men were more willing to get HPV vaccine if it protects against cancer as well as genital warts (path c; $b=.42, SE=.03, p<.001$) and men perceived cancer to be more severe than genital warts (path a; $b=.66, SE=.03, p<.001$). The next step was to examine whether men's perceived severity of HPV-related disease correlated with their vaccination willingness, while also including disease outcome framing in the model. Indeed, higher perceived severity of HPV-related disease was associated with higher vaccination willingness (path b; $b=.07, SE=.02, p<.001$). In this model, disease outcome framing remained associated with HPV willingness (path c'; $b=.37, SE=.02, p<.001$), though the effect was smaller. Sobel's test was statistically significant, providing evidence that perceived severity partially mediated the association between disease type and men's HPV vaccination willingness ($z=3.88, p<.001$).

Discussion

Overall, men were less willing to receive HPV vaccine when framed as preventing genital warts than when framed as also preventing several HPV-related cancers. This finding is

similar to those from studies in which women's interest in HPV vaccine for themselves and for their adolescent daughters was higher when it was presented as preventing cervical cancer. (10,11) While previous research indicated that including cervical cancer protection benefits for female partners did not affect HPV vaccine acceptability in males(12), we found that including cancer protection benefits for the males themselves resulted in greater acceptability of the vaccine. Furthermore, our experiment suggests that it does not matter which type of cancer was presented.

Consistent with other studies of HPV vaccine acceptability among males (12,29,30), men in our experiment were moderately willing to get vaccinated against HPV (31). While gay and bisexual men were more willing to get HPV vaccine than their heterosexual counterparts, our findings suggest that men respond similarly to different ways of framing HPV-related disease regardless of sexual orientation. Men in our study perceived their own risk of HPV-related disease to be low, despite a high prevalence of HPV infection nationally. Gay and bisexual men reported higher chances of getting genital warts, anal cancer, and oral cancer than did heterosexual men, which is logical since gay and bisexual men tend to have higher incidence of HPV infection and anal cancer compared to heterosexual men (16,32). This difference may also reflect gay and bisexual men's higher knowledge of HPV and HPV-related disease (33–35).

Vaccination willingness was higher among men in our study who perceived HPV-related disease to be more severe. In contrast, a study by Gerend and Barley (12) did not find perceived severity of HPV infection correlated with men's vaccine acceptability, and findings among women have been equivocal (36–38). This variability among vaccination studies is typical: our meta-analysis of 32 studies showed that the relationship of perceived severity to vaccine uptake is highly variable, but across studies is small and positive (39). The operationalization of perceived severity may affect its association with vaccination willingness. For example, assessing how much getting a disease would affect a person's life may yield different findings than one that assesses whether the disease can be deadly. Estimates of this relationship may also depend, at least in part, on outcome measures (e.g., willingness versus intentions) and sample populations. The association between disease severity and vaccine acceptability points to potential avenues for intervention and education. Health messages that emphasize severity of HPV-related disease may somewhat increase men's HPV-vaccination willingness.

In our experiment, perceived severity partially mediated the effect of disease outcome framing on HPV vaccination willingness, though this mediation effect was small. This finding adds to a small body of work showing mediators of framing effects (40,41) and provides empirical evidence for existing health behavior theories. Identifying perceived severity as a mechanism through which framing affects HPV vaccine acceptability also has implications for public health practice, as this finding may be useful for developing theory-based public health messages. Other potential mediators may include the perceived benefit of vaccinating for the men themselves or the belief that the vaccine is not only for women.

Strengths of our study include an experimental design, a large national sample, and a high participation rate. Our study is further strengthened by the inclusion of gay and bisexual men, a population at increased risk for HPV-related disease. Although the overall online survey panel closely matches the U.S. population on many key demographic characteristics (20,42), our sample may not have been fully nationally representative, as most men in our study were non-Hispanic white, of high socioeconomic status, and lived in urban areas. Since the study finished, the FDA approved use of HPV vaccine in boys and men ages 9 through 26 (1), making the inclusion of relatively few younger men a limitation of our study. However, the main finding of interest (differences by disease) could not differ by age

because they were within-subjects, and exploratory analyses showed that the other findings did not differ by age (data not shown), making the age of participants less of a concern. We did not randomize the order of the items for perceived likelihood and severity, making this part of our findings quasi-experimental and potentially subject to order effects. We asked men about their willingness to get themselves vaccinated against HPV, but it is likely that parents will make many vaccination decisions on behalf of their adolescent sons(43). Our findings suggest that men's willingness to vaccinate their sons would vary by the framing of the disease to be prevented, but this remains to be confirmed by future studies.

Public health messages about HPV vaccine should incorporate cancer-preventing benefits for men regardless of their sexual orientations, if clinical trials support cancer-protective benefits of the vaccine. While further research is needed to examine HPV vaccine acceptability and message framing among younger men and parents with male children, our study identifies potentially important factors of future communication efforts about HPV vaccine among men in the United States.

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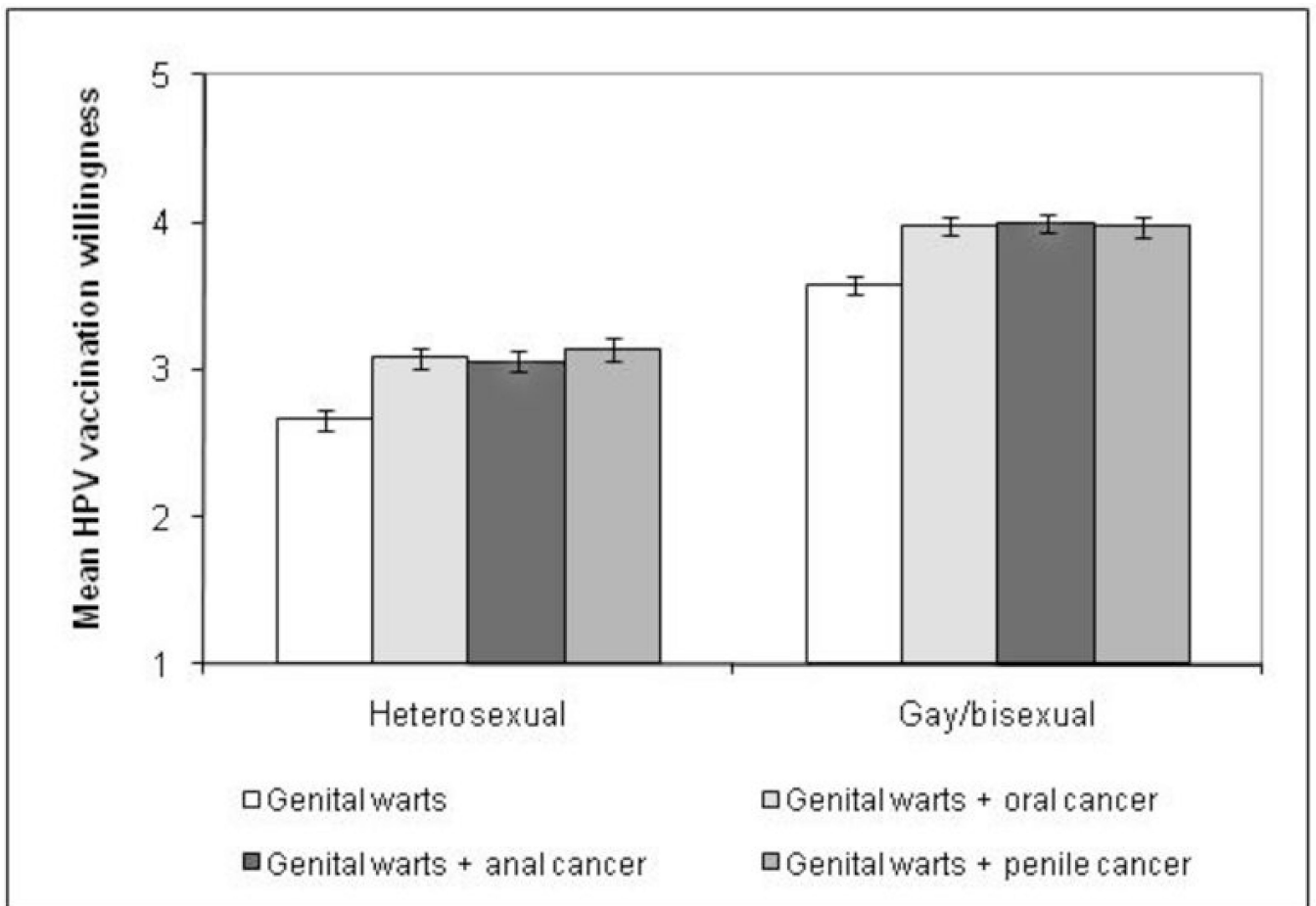


Fig. 1. Willingness to be vaccinated against HPV. Response scales ranged from 1="definitely not willing" to 5="definitely willing". Error bars report standard errors.

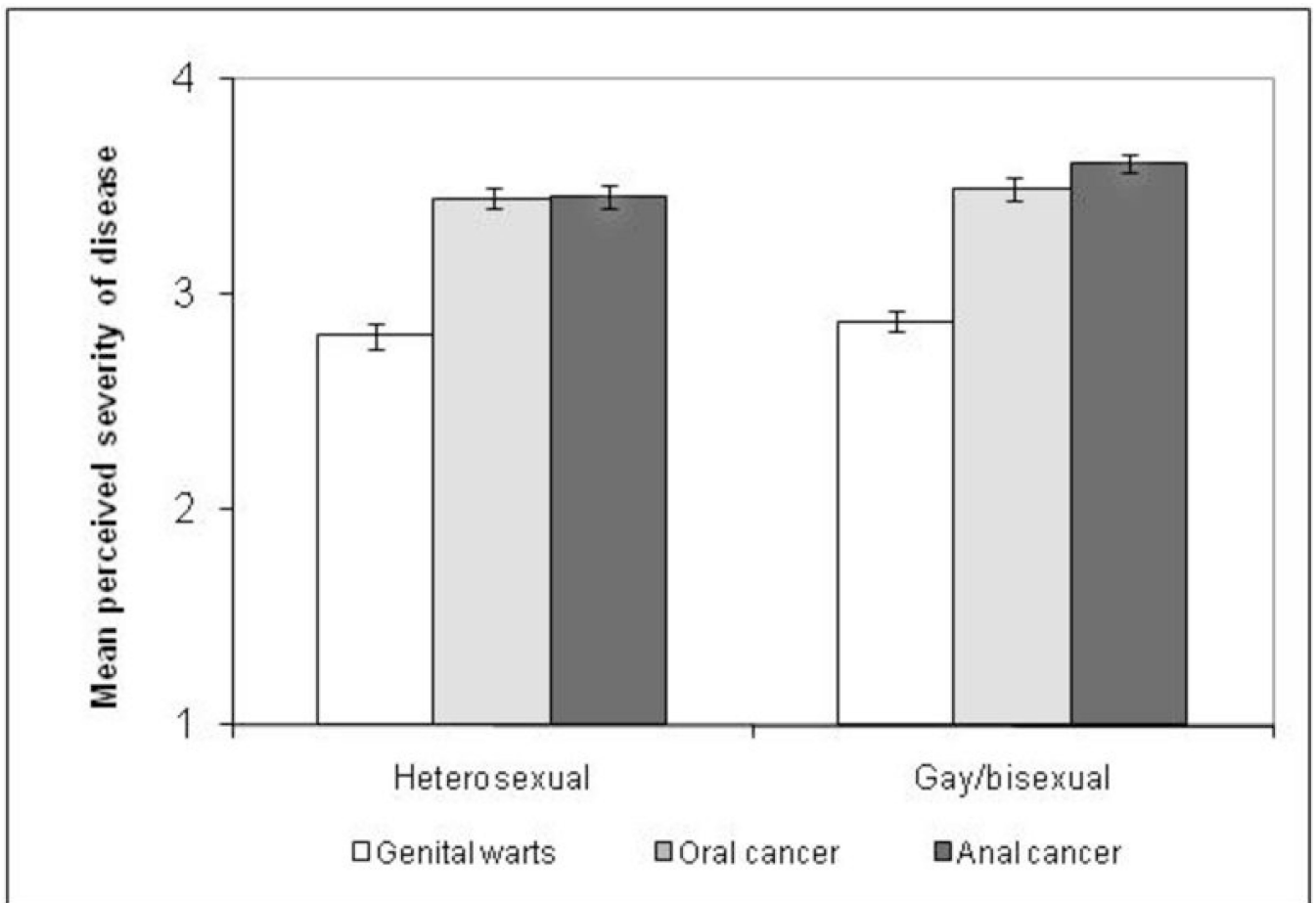


Fig. 2. Perceived severity of HPV-related diseases. Response scale ranged from 1="not at all" to 4="quite a lot". Error bars report standard errors.

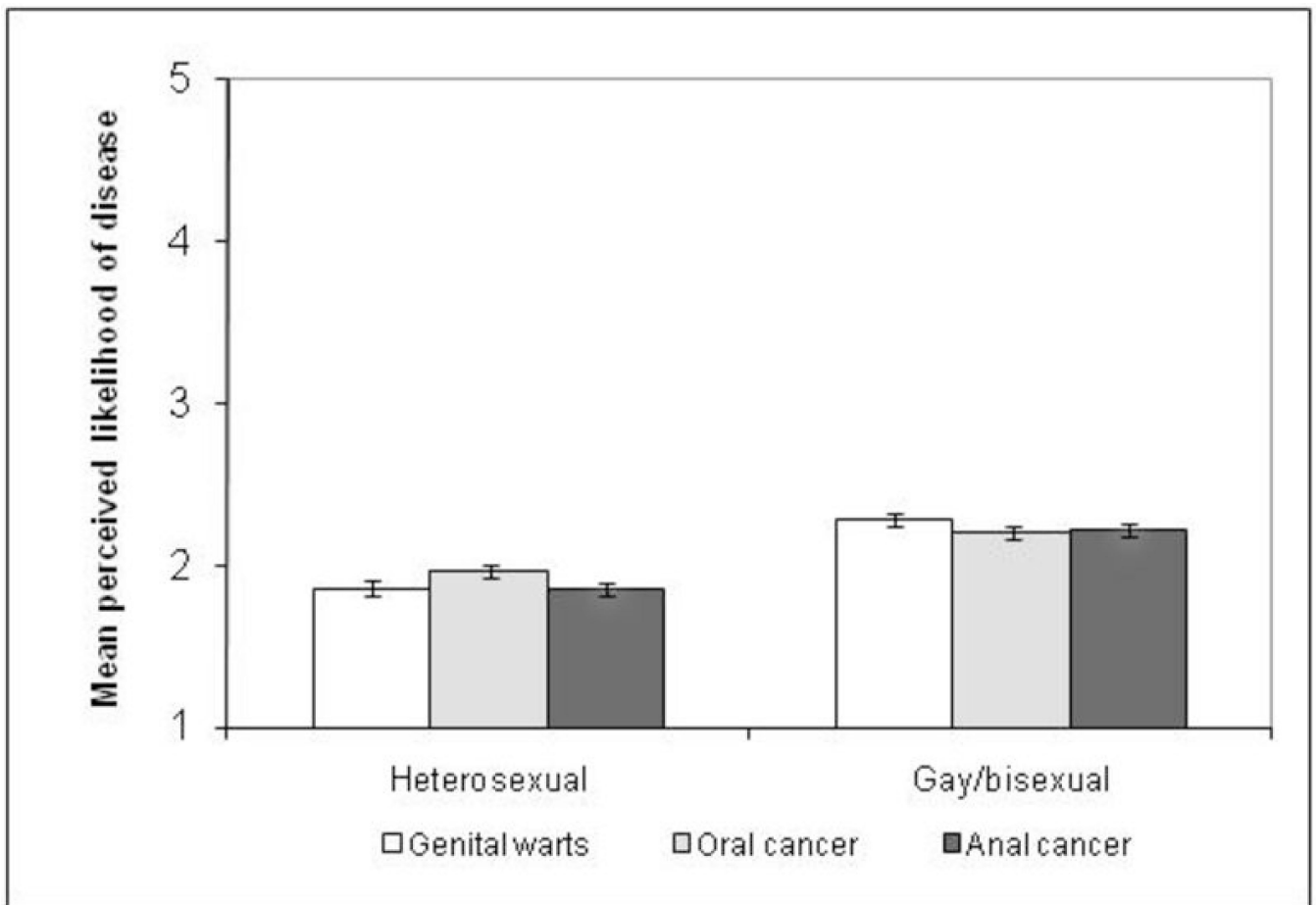


Fig. 3. Perceived likelihood of HPV-related diseases. Response scales range from 1="no chance" to 5="certain I will get [disease]". Error bars report standard errors.

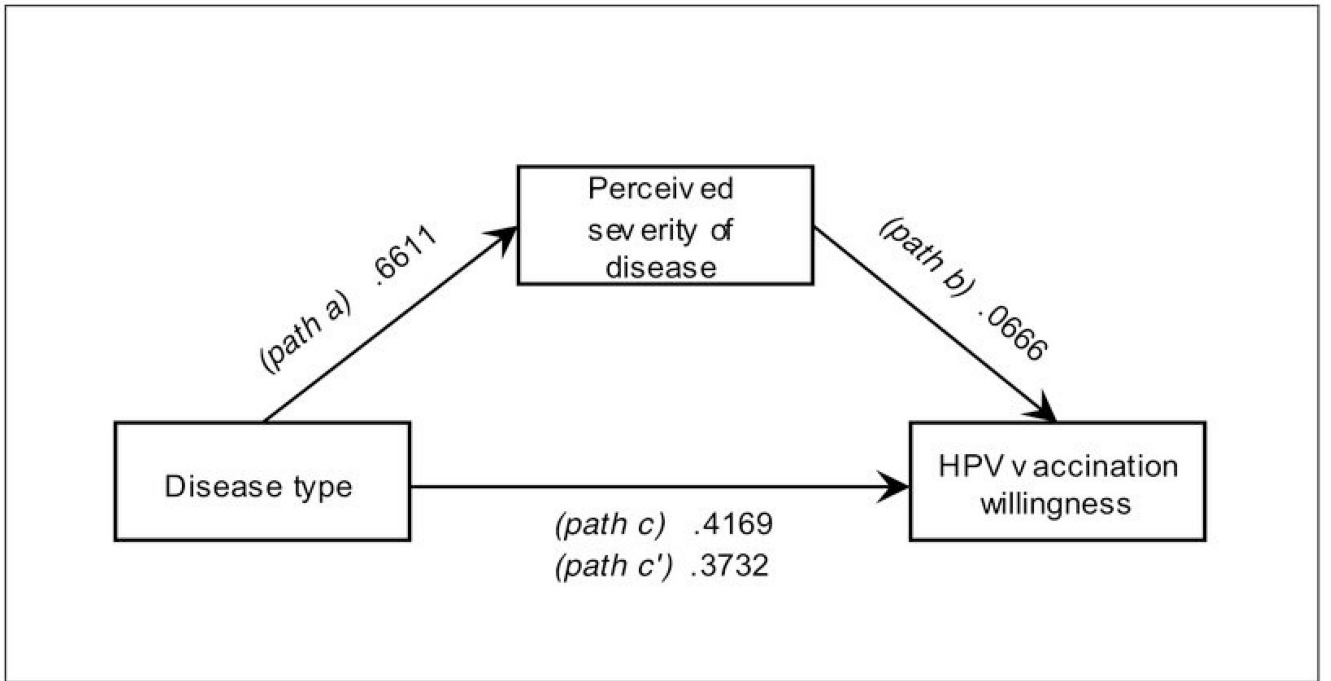


Fig. 4. Perceived severity disease partially mediated the effect of disease type (cancer vs. genital warts) on men's HPV vaccination willingness ($Z=3.88, p<.001$). Path b controls for disease type, and path c' controls for perceived disease severity

Table 1

Participant characteristics, University of North Carolina Men's Health Survey, 2009

	Overall n=608		Heterosexual n=296		Gay/bisexual n=312		Difference
	n	(%)	n	(%)	n	(%)	<i>p</i>
Age							***
18-26 years	48	(7.9)	34	(11.5)	14	(4.5)	
27-39 years	121	(19.9)	75	(25.3)	46	(14.7)	
40-49 years	217	(35.7)	90	(30.4)	127	(40.7)	
50-59 years	222	(36.5)	97	(32.8)	125	(40.1)	
Race/ethnicity							
Non-Hispanic White	483	(79.4)	230	(77.7)	253	(81.1)	
Other race/ethnicity	125	(20.6)	66	(22.3)	59	(18.9)	**
Education							
No college degree	335	(55.1)	197	(66.6)	138	(44.2)	
College degree or more	273	(44.9)	99	(33.4)	174	(55.8)	*
Annual household income							
<\$60,000	273	(44.9)	147	(49.7)	126	(40.4)	
\$60,000 +	335	(55.1)	149	(50.3)	186	(59.6)	**
Relationship status							
Other (divorced, widowed, separated, never married)	261	(42.9)	97	(32.8)	164	(52.6)	
Living with partner or married	347	(57.1)	199	(67.2)	148	(47.4)	**
Urbanicity							
Urban	534	(87.8)	242	(81.8)	292	(93.6)	
Rural	74	(12.2)	54	(18.2)	20	(6.4)	

* $p < .05$,*** $p < .001$.