



# Factors that Predict HPV Vaccination Behavior Among Young Men-Who-Have-Sex-with-Men in the Greater Philadelphia Region

Tyrell Mann-Barnes<sup>1,2</sup> · Aisha Bhimla<sup>1</sup> · Michael Coronado<sup>1</sup> · Timmy Lin<sup>1</sup> · Adebola Duro-Aina<sup>1</sup> · Hemi Park<sup>1</sup> · Grace X. Ma<sup>1,3</sup>

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## Abstract

Human papillomavirus (HPV) is one of the most common sexually transmitted infections in the USA. HPV is acknowledged as one of the leading causes of anal cancer, with an increased risk in men who have sex with men (MSM), when compared to age-matched heterosexual men. This study highlights the various factors that influence and impede HPV vaccination uptake among a multiracial cohort of young-MSM (YMSM). A total of 444 participants aged 18 to 27 in the Greater Philadelphia region completed an online survey. Approximately 75.79% ( $n=335$ ) of participants did not receive at least one dose of the HPV vaccine. Having a healthcare provider recommendation (OR=25.54, 95% CI: 25.54–85.42,  $p<0.001$ ) and a one unit increase in experiences of adverse effects of stigma and homophobia (OR=1.06, 95% CI: 1.01–1.11,  $p=0.044$ ) were associated with a greater likelihood of receiving the HPV vaccine uptake. Having a greater number of sexual partners (OR=0.85, 95% CI: 0.75–0.97,  $p=0.014$ ) and having had condomless anal sex in the past 6 months (OR=0.31, 95% CI: 0.15–0.58,  $p<0.001$ ) were associated with a lower odds of HPV vaccine uptake. In conclusion, healthcare provider-focused interventions and educational programs are needed to increase awareness and uptake of the HPV vaccine to mitigate the risks associated with sexual behaviors among this population.

**Keywords** Human papillomavirus · Sexually transmitted infections

## Introduction

Human papillomavirus (HPV) is the most common sexually transmitted infections (STI) in the USA [1]. Although a majority of HPV infections are transient, persistent HPV infection is associated with an increased risk of cancer. Specifically, HPV infection accounts for the development of more than 90% of anal and cervical cancers, more than 70% of oropharyngeal and vaginal cancers, and more than 60% of vulvar and penile cancers [1–4]. Although there are over 100 different genetic variations and HPV serotypes, 16 and 18 are considered to be the most common and most high-risk for cancer development [3, 5, 6]. HPV disproportionately

affects men-who-have-sex-with-men (MSM), in whom the prevalence has been reported to be as high as 60% [6].

Approximately 50% of those infections are caused by high-risk HPV types [7–10]. General major risk factors for contraction of HPV include engaging in high-risk sexual behaviors, such as early sexual debut and having multiple sexual partners, and unprotected sexual intercourse [7–9]. Furthermore, MSM have an increased chance of contracting high-risk HPV compared to heterosexual men due to engaging in sexual practices such as receptive anal intercourse [11–13].

Prevention of new HPV infection is accomplished through HPV vaccination. In the USA, Gardasil, a 9-valent HPV vaccine, is the only HPV vaccine currently distributed for use [14]. This vaccine confers protection against nine of the aforementioned high-risk HPV serotypes [14]. HPV vaccines are administered in a three-dose series to individuals 15 to 45 years old who initiate vaccination. The schedule of three doses is 0, 1 to 2 months, and 6 to 12 months, respectively. At present, the Advisory Committee on Immunization Practices (ACIP) recommends vaccination for all children and adults ages 9 through 26 years and catch-up vaccination for all individuals up to age 26 [15]. Despite current ACIP

✉ Grace X. Ma  
grace.ma@temple.edu

<sup>1</sup> Center for Asian Health, Lewis Katz School of Medicine, Temple University, Philadelphia, PA, USA

<sup>2</sup> University of Pennsylvania, Philadelphia, PA, USA

<sup>3</sup> Department of Urban Health and Population Science, Lewis Katz School of Medicine, Fox Chase Cancer Center, Temple University, Philadelphia, PA, USA

recommendations, young men who have sex with men (YMSM), ages 18–26, remain largely unvaccinated [16–18]. In a recent national study, the data displayed that only 6.8% of YMSM had received one dose or more of the HPV vaccine [7, 18]. Although this vaccination rate is an improvement in past years, there are still many YMSM that remain unvaccinated.

Numerous factors act as barriers to obtaining the HPV vaccination among MSM including psychosocial and healthcare-driven factors. Healthcare access-related barriers include cost, fear of needles, physician non-recommendation, and accessibility of primary care [19–21]. Only 4% of unvaccinated YMSM were recommended the vaccine by their primary care provider [7]. Individual-level barriers to HPV vaccination and screening include stigma, lack of knowledge, and inconsistent access to healthcare [14, 19, 22]. For MSM, this stigma is largely associated with sexuality, historical contextualization of gay health, and STI health [22]. Stigma may result in the increased likelihood of MSM avoidance or postponement of healthcare visits and decreased sense of self-efficacy [19, 22]. In addition to the aforementioned barriers to HPV vaccination and screening in MSM, YMSM experience additional individual-level barriers. These include being uninsured or insured under their parents and fear that either HPV screening or vaccination will show up on a medical bill [7]. Furthermore, another significant barrier is a lack of knowledge and awareness of HPV and its association with the potential development of cancer among MSM [20, 22, 23]. The aforementioned overall positive attitudes regarding vaccines, in general, are correlated with increased awareness and knowledge of the HPV vaccine [20, 22]. Studies indicate that MSM have expressed that with increased recommendation and education regarding the HPV vaccine, they would accept the vaccine [7, 20, 23]. In addition, self-efficacy has been shown to be associated with higher rates of reported vaccination and increased intention to become vaccinated against HPV [17, 24].

Limited research has been conducted on the YMSM population regarding HPV vaccination and perspectives, particularly with relation to ethnic minorities. Throughout the existing literature, there are few reports that focus on YMSM, and of those studies, many samples consist largely of non-Hispanic White males. Further research is required to understand the barriers to HPV vaccination and screening among YMSM. The current study addresses this critical gap in the literature. The aim of this study was to assess psychosocial, sexual behavioral, and healthcare factors that influence HPV vaccination uptake among YMSM.

## Methods

### Participants and Sample

Participants were recruited and subsequently enrolled from community-based organizations (CBOs), social media

(including LGBTQ Facebook groups), and university LGBTQ student organizations in the Greater Philadelphia region. Recruitment was accomplished through active engagement with CBO leaders, volunteers, online flyers, participant-driven referrals, and online ad placements. Institutional Review Board (IRB) approval was obtained for the study. Participants were recruited from September 2020 to January 2021 to participate in this cross-sectional study, which was administered online via Qualtrics. Participants were eligible to participate in this study if they: (1) were between 18 and 27 years of age; (2) self-identified as a man; (3) self-reported having sex with men in their lifetime (oral, anal, or both); (4) lived in the Greater Philadelphia region; and (5) were able to complete the survey in English. Participants who completed the survey received a \$20 gift card. A total of 2137 participants accessed the online Qualtrics survey, and after screening for eligibility a total of 444 participants were eligible to participate and were included in this study data sample for analysis. Reasons for ineligibility included that they were not between the ages of 18–27, did not self-identify as a man, reported not having sex with men in their lifetime, or did not live in the Greater Philadelphia region and thus did not move further in completing the survey.

### Measures

The online survey was used to capture self-reported data and all data was collected at a single time point for each participant. Metrics were selected for inclusion in the analysis based on the factors that were relevant and associated with HPV vaccination, as underlined in the preliminary literature review. The survey was developed in Qualtrics and contained the following sections:

**Demographic variables (7 items)**—Information on age, race/ethnicity, income, marital status, employment status, level of education, and housing security (experienced homelessness) was collected.

**Gender and sexual orientation (2 items)**—Information on gender and sexual identity and orientation was collected using Hauptert's inclusive gender identity measure [24, 25]. Gender identity was included in the eligibility criteria; thus, 100% of participants identified as male.

**Sexual behaviors (12 items)**—Information on sexual debut, number of sexual partners in the past 6 months, and having had condomless anal sex in the past month was collected [24, 25].

**Healthcare factors (3 items)**—Information about healthcare included whether the participant had health insurance, had a healthcare provider they visited, and whether a healthcare professional ever recommended the HPV vaccine.

HPV vaccination history (9 items)—Information on HPV vaccination, type of vaccination received, number of doses received, and location of vaccine administration was collected. The rationale for not receiving the HPV vaccine in unvaccinated participants and barriers to receiving the HPV vaccine in vaccinated participants were collected through a series of 12 statements and a 6-point Likert scale, ranging from strongly disagree to strongly agree. Participants were asked “Have you ever received the HPV vaccination (at least one dose)” with responses yes and no.

Knowledge about HPV (14 items)—Knowledge of HPV symptoms and perceptions of HPV risk were collected from participants. The first item required participants to identify the various symptoms that HPV may cause. This used a series of 13 statements accompanied by a 5-point Likert scale, ranging from “strongly disagree” to “strongly agree,” to identify participant knowledge regarding HPV. Knowledge regarding HPV transmission and attitudes toward HPV prevention strategies were collected. A 10-point Likert scale was used to evaluate participants’ knowledge of HPV prevention strategies. This section was adapted from a study by Forster et al. and Wheldon et al. [21, 26]. Items were summed with a maximum score of 75.

Adverse effects of stigma and homophobia (15 items)—Information regarding participant beliefs toward sexual orientation, fear of coming out, and perceived gay-related stigma was collected using a series of 15 statements and a 5-point Likert scale, which ranged from “strongly disagree” to “strongly agree.” The items from this section were adapted from the measures and investigator-adapted scale in a study on internalized homophobia and perceived stigma by Puckett et al. [26]. Items were summed with a minimum score of 5 and a maximum score of 75.

Perceived risk of becoming infected with HPV (6 items)—Information on one’s risk of being infected with HPV was collected through 6 items on a five-point Likert scale ranging from very unlikely (0) to very likely (5). Items were summed with a maximum score of 30.

Attitudes toward HPV vaccination (9 items)—Information regarding participants’ attitudes toward receiving an HPV vaccination was collected through the 9 items in this section. Both items consisted of a series of statements accompanied by a 5-point Likert scale with a maximum score of 45.

## Data Analysis

The study measures were descriptively summarized using means and standard deviations for continuous variables and frequencies and percentages for categorical variables, and bivariate analyses were presented by examining

categorical and continuous variables by vaccination status. Factors that were significant in the bivariate analyses were included in the logistic regression model. We ran a multicollinearity test to determine whether there were any variables in our model that were highly correlated with each other. There was no multicollinearity based on the tolerance, variance inflation, eigenvalues; thus, there were no threats to the assumptions for the regression model. Multivariable logistic regression was utilized to examine associations between sociodemographic/healthcare factors, HPV-related knowledge, sexual behaviors, and HPV vaccination. All hypothesis tests were two-tailed and *p* values less than 0.05 were considered statistically significant. All analyses were conducted in SAS 9.4.

## Results

### Descriptive Characteristics of Study Participants

The mean age of study participants was 23.1 years, with 65.90% identifying as non-Hispanic White, followed by non-Hispanic Black (14.87%), Hispanic/Latino (14.19%), and non-Hispanic other (5.03%). The majority of participants had completed some university level (54.18%) or high school/GED (42.21%). Most participants (85.81%) were currently employed, and more than half (65.16%) of participants made less than \$40,000 per year. In terms of housing security, 34.84% of participants experienced homelessness in the past. Most participants identified as gay (78.60%) and more than half of the study sample (61.5%) were not currently married or in a relationship, characterized as single, divorced, or widowed. In terms of healthcare characteristics, 93.86% of participants had health insurance, and 87.47% had a primary health care provider they visited, and 65% were recommended the vaccine by a health care provider. There were significant differences in income ( $p < 0.0001$ ), sexual orientation ( $p = 0.0296$ ), marital status ( $p = 0.0011$ ), and healthcare provider recommendation ( $< 0.001$ ) by vaccination status. These findings are displayed in Table 1.

### Characteristics of Sexual Behaviors and Psychosocial Factors by HPV Vaccination Status

The mean number of sexual partners in the past 6 months was 2.5 ( $\pm 2.4$ ) and the mean age of sexual debut was 17.78 ( $\pm 1.92$ ) years. Among the total sample, almost half of the participants reported having condomless anal sex in the past month. There were statistically significant differences in the number of sexual partners ( $p < 0.0001$ ) and age at sexual debut ( $p < 0.0001$ ) by vaccination status in the bivariate analysis. Furthermore, in terms of

**Table 1** Descriptive statistics of study participants by HPV vaccination status

Variable	Vaccination status		Total <i>n</i> (%) / mean (SD)	<i>p</i> value
	Yes <i>n</i> (%) / mean (SD)	No <i>n</i> (%) / mean (SD)		
Age	22.86 (2.19)	23.17 (2.13)	23.1 (2.15)	0.6963
Race/ethnicity				0.5103
Non-Hispanic Black	11 (17.19)	53 (82.81)	65 (14.87)	
Non-Hispanic White	71 (24.65)	217 (75.35)	288 (65.90)	
Non-Hispanic other	6 (27.27)	16 (72.73)	22 (5.03)	
Hispanic/Latino	17 (27.87)	44 (72.13)	62 (14.19)	
Education				0.1696
< High school	4 (26.67)	11 (73.33)	16 (3.61)	
High school/GED	37 (19.79)	150 (80.21)	187 (42.21)	
≥ University	66 (27.62)	173 (72.38)	240 (54.18)	
Employment status				0.2466
Currently employed	87 (23.26)	287 (76.74)	374 (84.81)	
Not currently employed	20 (29.85)	47 (70.15)	67 (15.19)	
Income				<b>&lt; 0.0001</b>
< \$40,000 per year	87 (30.21)	201 (69.79)	288 (65.16)	
≥ \$40,000 per year	20 (12.99)	134 (87.01)	154 (34.84)	
Experienced homelessness				0.2714
Yes	42 (27.27)	112 (72.73)	154 (34.84)	
No	65 (22.57)	223 (77.43)	288 (65.16)	
Sexual orientation				<b>0.0296</b>
Gay	84 (24.21)	263 (75.79)	349 (78.60)	
Bisexual	13 (17.81)	60 (82.19)	73 (16.44)	
Heterosexual	10 (45.45)	12 (54.55)	22 (4.95)	
Marital status				<b>0.0011</b>
Single/divorced/widowed	51 (18.89)	219 (81.11)	270 (61.5)	
In a relationship/married	55 (32.54)	114 (67.46)	169 (38.5)	
Insurance				0.8955
Not insured	6 (23.08)	20 (76.92)	27 (6.14)	
Insured	100 (24.21)	313 (75.79)	413 (93.86)	
Health care provider				0.9167
Yes	93 (24.28)	290 (75.72)	384 (87.47)	
No	13 (23.64)	42 (76.36)	55 (12.53)	
Health care provider recommendation				<b>&lt; 0.001</b>
Yes	104 (35.99)	185 (64.01)	289 (65.53)	
No	3 (1.97)	149 (98.03)	152 (34.47)	

Bolded values are significance of  $p < 0.05$

psychosocial factors, the total knowledge score was 44.36 ( $\pm 6.6$ ), perceived risk of contracting HPV was 13.02 ( $\pm 2.26$ ), attitudes toward HPV and the vaccine was 27.87 ( $\pm 3.81$ ), and experiences of stigma and homophobia were 48.45 ( $\pm 6.68$ ). There were statistically significant differences in HPV-related knowledge ( $p = 0.0008$ ), perceived risk of contracting HPV ( $p = 0.0361$ ), and experiences of stigma and homophobia ( $p = 0.0002$ ) by vaccination status in the bivariate analysis. Results are illustrated in Table 2.

### Multiple Logistic Regression as Predictors of HPV Vaccination History

The logistic regression analysis showed that having a healthcare provider recommendation (OR = 25.54, 95% CI: 25.54–85.42,  $p < 0.001$ ) and a one unit increase in experiences of adverse effects of stigma and homophobia (OR = 1.06, 95% CI: 1.01–1.11,  $p = 0.044$ ) were associated with a greater likelihood of receiving the HPV vaccine uptake. Having a greater number of sexual partners (OR = 0.85, 95% CI: 0.75–0.97,  $p = 0.014$ )

**Table 2** Characteristics of sexual behaviors and psychosocial factors by HPV vaccination status

Variable	Vaccination status		Total n (%) / mean (SD)	p value
	Yes n (%) / mean (SD)	No n (%) / mean (SD)		
<i>Sexual risk behaviors</i>				
# partners	3.24 (3.65)	2.23 (1.78)	2.5 (2.4)	<0.0001
Age at sexual debut	17.70 (1.93)	17.78 (1.92)	17.78 (1.92)	0.9734
Condom-less anal sex				<0.0001
Yes	80 (36.53)	139 (63.47)	219 (49.66)	
No	27 (12.22)	194 (87.78)	222 (50.34)	
<i>Psychosocial factors</i>				
HPV-related knowledge score	43.89 (7.49)	44.62 (5.82)	44.36 (6.6)	0.0008
Perceived risk of contracting HPV	13.02 (2.54)	13.02 (2.16)	13.02 (2.26)	0.0361
Attitudes toward HPV and the HPV vaccine	28.31 (3.83)	27.73 (3.79)	27.87 (3.81)	0.8635
Experiences of stigma and homophobia (max: 68)	48.02 (5.16)	48.58 (7.10)	48.45 (6.68)	0.0002

and having had condomless anal sex in the past 6 months (OR = 0.31, 95% CI: 0.15–0.58,  $p < 0.001$ ) were associated with a lower odds of HPV vaccine uptake. These results are illustrated in Table 3.

## Discussion

This study is one of few to examine the individual factors that are associated with HPV vaccination among YMSM. Approximately 75.79% ( $n = 335$ ) of the sample reported that they did not receive at least one dose of the HPV vaccine. This data is consistent with the national observation of low vaccination rates within the YMSM population, indicating a strong need to improve vaccination rates in this population [6, 12, 18]. The strongest predictor of HPV vaccination highlighted in this study was that a lack of

healthcare provider recommendations for the HPV vaccine was associated with a decreased likelihood of receiving the vaccine [17]. YMSM study participants who received a provider recommendation to obtain the HPV vaccine were 25 times more likely to receive vaccination uptake. The findings of this study are similar to another study conducted in the same population where a provider recommendation was the single largest predictor of uptake [17]. Although not investigated here, other studies have also found that there is low disclosure of same-sex sexual behavior among MSM [17, 27].

The present study also identified two behavioral indicators that were significant predictors of HPV vaccination among YMSM. These results support similar findings in HIV research that unprotected anal sex is a pervasive behavior that influences both real and perceived risk associated with STI transmission among YMSM [13, 28, 29]. Educational

**Table 3** Multiple logistic regression as predictors of HPV vaccination history

Variable	OR	95% CI LL	95% CI UL	p value
Income [ref: < \$40,000]	1.66	0.86	3.20	0.129
Race/ethnicity [ref: Hispanic/Latino]				
Non-Hispanic Black	1.63	0.57	4.67	0.078
Non-Hispanic White	0.87	0.37	2.08	0.873
Non-Hispanic other	0.48	0.13	1.79	0.154
Sexual orientation [ref: heterosexual]				
Gay	1.64	0.55	4.88	0.397
Bisexual	1.49	0.41	5.44	0.740
Healthcare provider recommendation [ref: no]	25.54	7.63	85.42	<0.001
Condomless anal sex [ref: no]	0.31	0.15	0.58	<0.001
# of sexual partners	0.85	0.75	0.97	<b>0.014</b>
HPV knowledge score	0.98	0.93	1.03	0.409
Adverse effects of stigma and homophobia	1.06	1.01	1.11	<b>0.044</b>
Perceived risk of HPV	0.99	0.86	1.14	0.922



interventions to promote the HPV vaccine, including sexual health education and other modifiable risk factors, are needed.

Philadelphia is one of the poorest major cities and it is crucial to understand how socioeconomic status and financial barriers to vaccine uptake promulgate disparities in vaccine utilization [30]. There is a dearth of information about the average copay or reimbursement for the HPV vaccine. Approximately 77% of study participants who self-reported being insured did not receive the vaccine, which implicates the lack of insurance as a barrier to HPV vaccination uptake. The Philadelphia Department of Public Health coordinates the Vaccines for Children (VFC) and Vaccines for Adults at Risk (VFAR) programs which enable providers to provide vaccines to make vaccines available free of charge to children and adults who are uninsured or under-insured [13]. YMSM may be eligible for either of these programs and future interventions could utilize these programs to mitigate financial barriers to vaccine utilization. Future studies should assess the varying health insurance-related barriers to HPV vaccine uptake among the target population.

The present study further identified several important indicators associated with a greater likelihood of individuals receiving the HPV vaccine. The hypothesis of the present study was that psychosocial factors, including experiences of stigma and homophobia, perceived HPV risk, and attitudes toward the HPV vaccine, would be associated with vaccination uptake. However, upon analysis, only a slight unit increase in adverse effects of stigma and homophobia was associated with vaccination status. In addition, education, socioeconomic status, access to primary healthcare providers, and insurance were not associated with HPV vaccination among YMSM. Thus, future interventions that aim to improve HPV vaccination uptake among MSM may require community-level intervention at sexual health clinics and CBOs, in addition to individual-level intervention to improve social norms relating to vaccine utilization [31].

Strengths of the present study include the utilization of a large sample of YMSM in an urban area that was composed of multi-ethnic participants. The cross-sectional design, COVID-19 pandemic, and study duration, however, were study limitations. The COVID-19 pandemic and study duration may have impacted the participation of racial and ethnic minorities who were not connected or affiliated with our recruitment partners at institutions of higher education. Further, the COVID-19 pandemic heavily impacted the participation and daily operations of our local CBOs that served as our recruitment partners. Resultantly, individuals classified as essential workers may have had limited access or awareness of the study. We utilized convenience sampling and patient-driven recruitment strategies targeting YMSM in the Greater Philadelphia region which limits the

geographic generalizability of our findings. This study did not control for the potential correlations between psychosocial, sexual behaviors, and healthcare factors. Moreover, this study was not able to capture participants who lack access to technology which may also implicate additional economic barriers to health insurance and access to healthcare. Nor was it possible to identify the specific causation of low HPV vaccination rates in the study population. Participants self-reported vaccination uptake, which may result in undercounting of vaccine utilization.

In conclusion, social, behavioral, financial, and healthcare-related factors place YMSM at a higher risk of contracting HPV [6, 7, 32]. Sexual risk behavior has been shown to be a predictive factor of HPV vaccination uptake. Thus, efforts to increase HPV education and awareness among YMSM are necessary to prevent individuals from contracting this preventable infection. Furthermore, there are opportunities to use behavioral economics strategies to nudge YMSM and healthcare providers to discuss and promote HPV vaccination among YMSM. Additional mixed-methods research is necessary to identify mental models among YMSM regarding vaccination uptake. The present study demonstrates a social norm of low HPV vaccination completion among YMSM in Philadelphia. Our findings underline the importance of healthcare provider recommendations in driving HPV vaccination uptake in the target population. This observation necessitates a population and individual-level intervention that addresses behavioral barriers to HPV uptake by targeting providers and YMSM. Lastly, there is a need to promote LGBTQ specific clinical recommendations for the vaccine through culturally sensitive strategies that address barriers among MSM.

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**Author Contribution** All authors contributed to the study's conception and design. Material preparation, data collection, and analysis were performed by Tyrell Mann-Barnes, Aisha Bhimla, Ph.D., Timmy Lin, Hemi Park, Michael Coronado, Adebola Duro-Aina, and Grace Ma, Ph.D. The first draft of the manuscript was written by Tyrell Mann-Barnes, Aisha Bhimla, Michael Coronado, Adebola Duro-Aina, and Dr. Ma and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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**Availability of Data and Material** Not applicable.

**Code Availability** Not applicable.

## Declarations

**Ethics Approval** This study was approved by Temple University Institutional Review Board.

**Consent to Participate** Informed consent was obtained from all individual participants included in the study.

**Consent for Publication** All participants provided informed consent regarding their data from the study.

**Competing Interests** The authors declare no competing interests.

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