Original Article

HPV vaccination coverage and disparities among three populations at increased risk for HIV

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Background: Rates of cervical, oropharynx, anal, and other cancers associated with the human papilloma virus (HPV) continue to rise in the United States. Despite data on the vaccine's efficacy to reduce HPV and associated cancers, uptake continues to be low among all populations. This is especially troubling among those who may be at increased behavioral risk for HIV infection. Few studies have documented differences in HPV vaccination among these groups.

Methods: Between 2012-2014, data were collected among three populations at increased risk for HIV using the New Orleans arm of the Centers for Disease Control and Prevention funded National HIV Behavioral Surveillance system. Females from the IDU and HET cycles, and males from the MSM cycle who met on the ACIP guidelines were included in this analysis.

Results: Of the 358 participants analyzed, 15.1% received at least one dose of the HPV vaccine. Among women, age was negatively associated with HPV vaccine (F=5.33, P=0.0224). African American women were also less likely to receive the HPV vaccine compared to other racial/ethnic groups (P=0.0292). Among MSM, HPV vaccine uptake was associated with having been tested for a STD in the past 12 months (P=0.0185) and having ever received a hepatitis vaccine (P=0.0042).

Conclusions: Increasing vaccination coverage among those eligible is necessary to aid in lowering the prevalence of cancers associated with HPV. These results highlight the need for more research to expand our understanding of structural issues hindering populations at risk for HIV infection who are eligible for the HPV vaccination from receiving it.

Keywords: Cancer; human papilloma virus (HPV); health disparities; risk behaviors; national HIV behavioral surveillance

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Introduction

Rates of cervical, oropharynx, anal, and other cancers continue to rise in the United States (1-4). Many of these cancers are associated with the human papilloma virus (HPV), which is the most common sexually transmitted infection. The majority of sexually active men and women will acquire at least one form of the virus in their lifetime. While many HPV strains clear on their own and do not require treatment, there are at least 13 types of HPV that are considered high risk because they can persist and progress to cancers (5).

According to the CDC, more than 90% of anal and cervical cancers, 70% of vaginal and vulvar cancers, and over 60% of penile cancers are caused by HPV (6). Further, while cancers of the head and neck are predominantly attributed to tobacco and alcohol abuse, recent studies suggest that approximately 70% of cancers of the oropharynx are also linked to HPV infections (6). Recent trends in incidence suggest that by 2020, the annual number of cancers of the mouth and throat attributed to HPV is expected to exceed the number of cervical cancer cases (7).

Due to the primary mode of transmission (i.e., sexual

contact), people who are at high risk for HIV infection, or who are already infected with HIV, are at increased risk for anogenital and oral HPV infection (8,9). Other factors that contribute to greater risk for HPV infection include multiple sex partners, being younger than 25 years of age, early sexual debut (less than 16 years of age), and having a male partner who is not circumcised or, for men, not being circumcised (10). Individuals with weakened immune systems (including those with HIV) who get infected with HPV are more likely to develop HPV-related cancers. Further, men who engage in receptive anal sex are more likely to contract anal HPV and develop anal cancer.

Vaccination is an effective way to reduce HPV and associated cancers. The vaccine is designed to be administered in three doses over a 6-month period. Proper uptake can potentially reduce two thirds of cervical cancer mortality worldwide as well as other HPV associated cancers in males and females and genital warts (11). In addition, the HPV vaccine can greatly reduce the need for medical treatment such as biopsies and other invasive procedures associated with abnormal screenings which not only helps to minimize health care costs, but can also allay anxieties related to follow-up procedures (12).

In 2006 the Advisory Committee on Immunization Practices (ACIP) recommended the use of quadrivalent HPV vaccine for females between nine and 26 years old (13). The recommendation has since expanded to include males 11 through 21 years of age (14). Under the ACIP guidelines, vaccination is recommended for females who have not previously been vaccinated, through 26 years of age. In general, vaccination coverage is recommended for males men who have sex with men (MSM), who have not previously been vaccinated, through 21-years of age (15). This set of differential recommendations has been attributed to a higher level of incidence in HPV related cancers among women and MSM (16,17).

Despite data on its efficacy, vaccine uptake continues to be low among all populations. Data from 2014 statistics show that four out of ten adolescent girls and six out of ten adolescent boys have not started the HPV vaccine series in the United States (18). Various demographic, socioeconomic, and psychological factors have been shown to influence an individual's decision to receive the HPV vaccination. Some of these factors include low SES, lack of health insurance, minority status, age, mistrust of the healthcare system, cultural influences on health seeking and health decision making, and convenience (19,20). Past research has indicated that there are gender differences in barriers to HPV vaccination (21). However, few studies have documented differences among populations widely accepted as being at highest risk for HIV transmission including MSM, injection drug users (IDU), and heterosexuals at increased risk for HIV infection (HET). The purpose of this study, therefore, is to assess demographic and behavioral differences in HPV vaccine uptake between these populations at high risk for HIV infection.

Methods

Data were collected during the Centers for Disease Control and Prevention funded National HIV Behavioral Surveillance (NHBS) system. NHBS is conducted in 21 cities in the United States with the highest HIV burden. Behavioral survey data are collected among the three populations at highest risk for HIV in rotating annual cycles; men who have sex with men (MSM), injection drug users (IDU), and heterosexuals at increased risk for HIV infection (HET) (22,23). While methods have been explained in more detail elsewhere, venue day time sampling (VDTS) was used to sample MSM and respondent driven sampling (RDS) was used to survey IDU and HET participants (24). VDTS is a two stage sampling technique wherein a frame of venues that are attended by the population of interest is enumerated and randomized in the first stage, which is followed by systematic sampling of individuals at scheduled events. RDS is a modified chain referral technique that starts with a set number of initial 'seeds' who are known members of the population who are surveyed, trained, and incentivized to recruit a set number of other members of the population. These participants may also recruit in that fashion until the desired sample size and requisite number of 'waves' of recruitment is reached. All protocols were approved by the Louisiana Department of Health and Louisiana State University Health Sciences Centers institutional review boards.

Between 2012 and 2014, 579 MSM, 495 IDU, and 552 HET completed behavioral surveys and were tested for HIV as part of the study. Eligibility criteria for all cycles were that the individual be at least 18 years of age, a resident of the New Orleans metropolitan area, and able to complete the survey in English. Additional cycle specific eligibility requirements included (I) being born a male and having had sex with another man in the past 12 months for NHBS-MSM (II) having injected illicit drugs in the past 12 months for NHBS-IDU; and (III) having had sex with an opposite sex partner in the past 12 months and be recruited by a previous respondent who either lived in an area of high risk for HIV and poverty or who were themselves living below the poverty line or had a high school or less level of education (25-27).

The data from each cycle were restricted to only

individuals who met either the 2006 ACIP recommendation for females or the 2011 recommendation for MSM (15). Women who were older than 26 years of age in 2006 were excluded from these analyses. Furthermore, MSM who were older than 26 in 2011 were also excluded. This resulted in final sample sizes of 141 women and 217 MSM all of whom would have been eligible at some point for HPV vaccination.

All data were stratified by gender. Chi-square tests were performed to examine the unadjusted relationships between HPV vaccine uptake and sample characteristics. Pearson correlations were assessed and Fisher's exact test was used when appropriate. An ANOVA test was used to examine the relationship between age and HPV vaccine uptake.

Two logistic regressions were then used to examine all other adjusted relationships. Two models were generated, one for women and one for MSM. The outcome variable of interest was self-reported having ever received at least one dose of the HPV vaccine. Sociodemographic variables included age, race, education, and current health insurance status. Additional predictor variables included having been tested for a STD in the past 12 months, HIV positivity, ever diagnosed with herpes, ever diagnosed with genital warts, and ever received the hepatitis vaccine. For consistency, covariates were derived from a larger MSM specific analysis of HPV vaccine uptake conducted by Meites *et al*. (4).

Results

Of the 358 participants who were eligible to receive the HPV vaccination according to the ACIP guidelines, 15.1% received at least one dose. *Table 1* presents sociodemographic and bio-behavioral characteristics of the 358 eligible participants. Among women, 80.1% were Black/African American, 68.1% reported currently having health insurance, and 57.1% were tested for a STD in the past 12 months. Among men, 54.4% were Black/African American, 66.4% reported having health insurance, and 59.7% were tested for a STD in the past 12 months. When stratified for gender, the prevalence of HPV vaccination uptake for women and men was 15.3% and 14.9%, respectively.

Table 2 presents both unadjusted stratified associations of HPV vaccination uptake between men and women. For women, age was negatively associated with HPV vaccine uptake (F=5.33, P=0.0224). African American women were also much less likely to receive the HPV vaccine compared to other racial/ethnic groups (P=0.0292). For men, several bio-behavioral factors among MSM were associated with HPV vaccination uptake including having been tested for a STD in the past 12 months (P=0.0185) and having ever received a hepatitis vaccine (P=0.0042). Other sociodemographic factors such as education, sexual identity, and having health insurance were not significantly associated with HPV vaccination uptake for both men and women.

Two models were created to account for demographic and bio-behavioral differences between men and women. For women, we adjusted for age, race, education, current health insurance coverage, and STD testing in the past 12 months. For men, we also included sexual identity. Race was no longer a significant predictor of HPV vaccine uptake among women. For MSM there were no significant associations after adjusting for relevant covariates.

Discussion

This study confirms the need for increased vaccination, which is necessary to aid in lowering the prevalence of cancers associated with HPV (1,24). This is particularly true among people at increased risk for HIV and other sexually transmitted diseases. Age was negatively associated with having received the HPV vaccine for women. This is likely due to a lag in uptake by the medical community after the recommendations were implemented as well as a decreased time of opportunity for vaccination (1).

Data regarding the MSM population mirror some of the known associations presented in previous literature addressing uptake of HPV vaccine (4). Education level and access to healthcare services were not significantly associated with HPV vaccine coverage, which differ from other reports on HPV vaccination coverage (1,4). Bio-behavioral risk factors such as STD testing in the past 12 months and prior vaccination for hepatitis are associated with increased uptake of the HPV vaccine among MSM.

Previous studies have documented racial disparities in HPV related cancer mortality. African American women continue to bear an excessive burden of cervical cancer as demonstrated by racial disparities in cervical cancer incidence, late stage diagnosis, and survival rates (28). Furthermore, the mortality rate for anal cancers among Black men is 27 per 100,000 compared to 18.1 per 100,000 for White men (29). While these data show a bivariate correlation between race and HPV vaccine uptake among women, this association does not hold true when adjusting for relevant structural covariates. This is important because it indicates that these structural covariates may play an instrumental role hindering Black women already at risk for HIV infection from accessing the HPV vaccination.

Among MSM, the major predictors of receiving the vaccination were having been vaccinated for hepatitis and having been tested for HIV in the past 12 months. This could be related to high utilization of LGBT specific

Table 1 Demographic characteristics of men and women at increased risk of HIV eligible for the HPV vaccination according to the ACIP guidelines

Characteristics	Female NHBS HET3/IDU3 participants		Male MSM4 participants	
	n	%	n	%
Ever received HPV vaccination				
No	116	84.7	177	85.1
Yes	21	15.3	31	14.9
Race/Ethnicity				
Black/African American	113	80.1	117	54.4
Other	28	19.9	98	46.6
Education				
Less than high school	44	31.2	10	4.6
High school diploma or equivalent	64	45.4	71	32.7
Some college or higher	33	23.4	136	62.7
Sexual identity				
Straight	121	85.8	5	2.3
Bisexual	3	2.1	170	78.7
Gay/Lesbian	17	12.1	3	19.0
Currently have health insurance				
No	45	31.9	73	33.6
Yes	96	68.1	144	66.4
Tested for STD in the past 12 months				
No	60	42.9	87	40.3
Yes	80	57.1	129	59.7
HIV positivity				
Negative	135	98.5	154	78.2
Positive	2	1.5	43	21.8
Ever diagnosed with genital herpes				
No	127	90.1	208	96.3
Yes	14	9.9	8	3.7
Ever diagnosed with genital warts				
No	135	95.7	207	95.4
Yes	6	4.3	10	4.6
Ever received a hepatitis vaccine				
No	80	66.1	82	42.0
Yes	41	33.9	113	58.0

ACIP, Advisory Committee on Immunization Practices; HPV, human papilloma virus; NHBS, National HIV Behavioral Surveillance.

Table 2 Eligible female NHBS HET3/IDU3 and male MSM4 participants who received at least one dose of the HPV vaccine

Characteristics	Female NHBS HET3/IDU3 participants			Male MSM4 participants		
	n	%	P value (unadjusted)	n	%	P value (unadjusted)
Total	21	15.3		31	14.9	
Age			0.0224			0.3189
Race/ethnicity			0.0292			0.0824
Black/African American	13	11.9		10	10.4	
Other	8	28.6		21	19.1	
Education			0.2587			0.4906*
Less than high school	5	11.6		0	0	
High school diploma or equivalent	8	13.1		10	14.5	
Some college or higher	8	24.2		21	16.3	
Sexual identity			0.8372*			1.000*
Straight	18	15.4		0	0	
Bisexual	0	0		25	15.4	
Gay/Lesbian	3	17.6		6	15	
Currently have health insurance			0.6503			0.1268
No	6	13.3		7	9.7	
Yes	15	16.3		24	17.7	
Tested for STD in the past 12 months			0.3123			0.0185
No	7	11.9		7	8.1	
Yes	14	18.2		24	19.8	
HIV status			1.000*			0.0847
Negative	20	15.3		20	13.3	
Positive	0	0		10	24.4	
Ever diagnosed with genital herpes			0.6949*			1.000*
No	20	16.3		30	15.1	
Yes	1	7.1		1	12.5	
Ever diagnosed with genital warts			0.5902*			0.3645*
No	21	16		31	15.7	
Yes	0	0		0	0	
Ever received a hepatitis vaccine			0.1994			0.0042
No	8	10		6	7.4	
Yes	7	18.4		25	22.9	

*, Fisher's exact. HPV, human papilloma virus; NHBS, National HIV Behavioral Surveillance.

services within the community and increased awareness of the risk among those providers. This presents an important opportunity for future research regarding vaccination coverage to reduce the overall risk of developing HPV and related cancers among MSM. Since incidence of anal cancers is 40 times higher in MSM than the general population (3,30), with even higher rates among HIV positive MSM, it is important to expand our understanding of vaccination coverage within this population.

There are several limitations to this study. First, this study uses data collected over three cross-sectional study cycles. This presents some time related issues that may influence vaccination coverage. Every additional year of data collection may conflate the overall findings. Further, the study design is cross-sectional and uses self-reported data. There is no way to confirm the validity of participant responses to receiving the HPV vaccine, therefore the data are inherently subject to recall bias. Finally, the data are not nationally represented, but rather provide evidence to metropolitan-level data specific to New Orleans. Despite these limitations, this is the first study to our knowledge to examine stratified data on HPV vaccination coverage among men and women at increased risk for HIV infection.

These findings highlight the increased need for research to expand our understanding of structural issues hindering African American women and MSM from receiving the HPV vaccination. Future study should investigate how physician's messages regarding the HPV vaccine differ according to the patient's gender and sexual orientation. Additional research should also explore whether women are more informed of the HPV vaccine through receipt of annual gynecology exams and the extent to which physicians are aware of these disparities. Overall, these findings can inform the development of targeted intervention programs designed to improve existing efforts and mitigate structural inequalities associated with HPV vaccination coverage.

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Footnote

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Ethical statement: Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by appropriate IRBs at DHH and LSUHSC. Verbal informed consent was obtained from the participants under a waiver of documentation of informed consent.

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