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Sexual mixing patterns and anal HPV among young gay, bisexual, and other men who have sex with men and transgender women in 2 cities in the United States, 2012–2014

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Abstract

Background: Human papillomavirus (HPV) is a common sexually transmitted infection. Men who have sex with men (MSM) and transgender women (TGW) are at high risk for anal HPV infection and subsequent anal cancer. This study assessed the association of partner discordances with prevalent high-risk anal HPV (HRAHPV) among MSM and TGW.

Methods: Participants were enrolled in the cross-sectional Young Men's HPV (YMHPV) study of gay, bisexual, and other MSM, and TGW, aged 18–26 years, from two cities. Participants completed a confidential standardized computer-assisted interview and provided self-collected anal swabs for type-specific HPV DNA testing. Multivariate analyses were conducted for three discordances of interest (i.e., partner age, race/ethnicity, and concurrent partner) to calculate adjusted odds ratios (aOR) and 95% confidence intervals (CI).

Results: 862 participants were included for partner race/ethnicity discordance, 601 for partner age discordance, and 581 for concurrent partner analysis. Most reported being >21 years old, cisgender male, and gay. Adjusted odds of HRAHPV were not significantly increased among participants reporting partner age discrepancy >10 years (aOR:0.89; CI:0.51, 1.56), partner race/ethnicity discordance (aOR:0.88; CI:0.62, 1.24), or partner with concurrent partners (aOR:0.85; CI:0.50, 1.42), compared to those who did not.

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Conclusions: This analysis did not identify any partner discordances associated with HRAHPV. Since HPV infection can persist for years, sexual mixing patterns with early partners might be more relevant than the most recent sex partner. Prevalence of HRAHPV was high and could be preventable by pre-exposure vaccination, as recommended for everyone through age 26 years including MSM and TGW.

Summary:

Among 1,033 young MSM, high-risk anal HPV was not associated with characteristics of the most recent sex partner, including age discrepancy >10 years, race/ethnicity discordance, or partner with concurrent partners

Keywords

Papillomavirus infections; Sexual and Gender Minorities; Sexual Health; Sexual Behavior; Sex Partners

Introduction

Human papillomavirus (HPV) is the most common sexually transmitted infection (STI) worldwide.[1] In the United States, there are about 79 million prevalent cases of HPV, and about 14 million incident HPV infections annually.[2,3] There are more than 150 different types of HPV, with about 14 types (including HPV types 16, 18, 31, 45, and others) considered high-risk types due to their association with cervical, oropharyngeal, and anogenital cancers.[3–8] Approximately 34,000 HPV-attributable cancer cases occur in the United States per year, of which 20,000 occur among women and 14,000 among men.[9–11] Among anal cancers, 91% of U.S. cases are attributable to HPV, most of which have been associated with HPV 16 or 18.[6,10,12,13].

In 2011, the United States became the first country to recommend gender-neutral HPV vaccination. HPV vaccination is recommended for people through age 26 years, including men who have sex with men (MSM) and transgender women (TGW).[11,14,15] Uptake of HPV vaccine among young men, including MSM in the United States remains low.[1617] Among 808 MSM and TGW aged 18–26 years from Chicago and Los Angeles participating in the Young Men's HPV Study in 2012–2014, 13.7% self-reported receiving at least one HPV vaccine dose, whereas the National Health Interview Survey found that among U.S. males and females aged 19–26 years in 2017, 21.2% and 51.8% respectively had received at least one dose.[18–20]

HPV prevalence among males has been evaluated in a population-based study in the United States demonstrating that 12.5% of persons age 14–19 years, 38.2% of persons age 20–24 years, 48.5% of persons age 25–29 years, and over 45% of persons age ≥30 years had any genital HPV strain. HPV prevalence varied by race/ethnicity, with prevalence highest among non-Hispanic blacks (59.4%), other race/ethnicity (43.3%), and non-Hispanic whites (41.0%), and lowest among Asians (23.7%).[21]

Among MSM, risk for anal HPV infection increases with higher number of lifetime sex partners, higher number of times as the anal-receptive sex partner, and younger age at first sex (sexual debut).[22,23] Studies have also found that MSM with human immunodeficiency virus (HIV) infection, risk for anal HPV incidence, persistence, and cancer is higher than among MSM without HIV infection.[13,24,25] Sexual social network characteristics among heterosexuals, such as difference in age between sex partners and concurrent partnerships, have been shown to be risk factors for HPV infection. Among women in Pakistan, age-discordant relationships of greater than or equal to 10 years were positively associated with having HPV [odds ratio (OR) 6.9; 95% confidence interval (CI) 1.5, 32.0].[26] Women in the United States with concurrent partners have been reported to have higher prevalence of high-risk cervical HPV (29.4%) compared to those without concurrent partnerships (19.3%, p=0.004).[27] To date, there have been no published HPV studies investigating partner age difference phenomena among MSM and TGW. In addition, no published HPV studies have looked at other partner-level differences including race/ethnicity or partner concurrency.

The objective of our study is to assess whether sexual mixing patterns, specifically discordance by partner characteristics, are associated with HPV infection. Partner age discordance, race/ethnicity discordance, and concurrent partnerships were hypothesized to be aspects of sexual mixing patterns given that these have been previously associated with bacterial sexually transmitted diseases but have not been assessed with high risk anal HPV (HRAHPV).[28]

Therefore, we assessed associations between these three partner discordances (i.e., partner age discordance, race/ethnicity discordance, and concurrent partner) and HRAHPV among MSM and TGW aged 18–26 years.

Methods

Study design and population

Data for this study were collected as part of the Young Men's HPV (YMHPV) study, a cross-sectional study of 1,033 gay, bisexual, and other MSM and TGW aged 18–26 years. Participants were recruited from three clinical facilities providing STI/HIV care to LGBT communities in Chicago, IL, and Los Angeles, CA, between July 2012 and August 2014. Detailed methods have been reported previously.[3,19,29,30] A nominal gift card was provided to participants as compensation. The study protocol was reviewed and approved by the Institutional Review Boards at the participating institutions: University of California at Los Angeles, County of Los Angeles Public Health; Howard Brown Health Center; University of Kentucky; and Centers for Disease Control and Prevention. All participants provided written informed consent.

Participants were eligible for inclusion in this analysis if they: (a) were aged 18–26 years; (b) were assigned male sex at birth, regardless of current gender identity or expression; (c) self-identified as gay/homosexual or self-reported ever engaging in oral or anal sex with a male partner; and (d) provided a self-collected anal swab specimen with an adequate HPV testing result. Participants were included in evaluation for a specific partner discordance if

they provided any answer to a question about that discordance. Participants who reported receiving any HPV vaccine dose/s were excluded from analysis.

Data collection and measures

Data collection consisted of a two-part process. Participants first completed a confidential standardized computer-assisted interview (CASI) in English. The CASI asked questions on demographics, sexual behaviors, HPV vaccination status, as well as knowledge and attitudes regarding HPV. Survey data were collected in web-based Qualtrics (Provo, UT). Each participant received a unique study ID number and no personally identifying information was collected.

All participants had been assigned male sex at birth. Participants were also asked about their current gender identity which was categorized as cisgender male, transgender female, or other (specifically including “questioning,” “queer,” and other gender identities).

Discordance is defined in our study as a sex partner characteristic that is different from that of the study participant. We assessed partner discordances by asking participants about characteristics of their most recent sex partner. Partner age discordance, race/ethnicity discordance, and concurrent partner were the three predictors of interest. First, age difference was measured by asking, “How close in age were you to your last sex partner?” with answer choices categorized as within 3 years of your age; within 4–5 years of your age; within 6–10 years of your age; within 11–20 years of your age; more than 20 years different from your age; couldn’t tell the age. Second, participants were asked about the race/ethnicity of their most recent sex partner, if known. Third, partner with concurrent partners was assessed by asking, “Not including you, how many other sex partners do you think (your partner) had in the past three months?” with a numeric answer, if known. All participants during July 2012 through August 2014 were asked about partner race/ethnicity discordance and concurrent partner. Only participants during August 2013 through August 2014 were asked about partner age discordance as described above. Participants were informed that they could skip any question if they preferred.

Following the CASI, participants self-collected an anal swab specimen for HPV testing. Illustrated schematic instructions were provided to aid in specimen collection. Specimens were sent to CDC for HPV detection and typing with Research Use Only Linear Array HPV Genotyping Test (Roche Molecular Systems, Branchburg, NJ) using previously described methods.[30]

Laboratory and Statistical Analyses

The primary outcome for this analysis was high-risk anal HPV infection. The Linear Array assay detects 37 types (HPV 6, 11, 16, 18, 26, 31, 33, 35, 39, 40, 42, 45, 51, 52, 53, 54, 55, 56, 58, 59, 61, 62, 64, 66, 67, 68, 69, 70, 71, 72, 73, 81, 82, 83, 84, 89, IS39; with beta-globin control). Specimens negative for beta-globin and all HPV types were considered inadequate for evaluation and dropped from analysis. Any participant with HPV 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, or 68 detected in the anal swab was considered positive for HRAHPV.[8] Participants were dichotomized into those who tested positive for HRAHPV versus did not test positive for HRAHPV.

Descriptive analyses included frequencies with median and interquartile range (IQR)among populations for partner age discordance, race/ethnicity discordance, and concurrent partner.

Bivariate analyses using chi-squared tests, paired t-tests, one-way ANOVA, and Fisher's exact tests per respective variable were performed for demographics, sexual behaviors, partner characteristics, and HPV prevalence with partner age discordance, race/ethnicity discordance, and concurrent partner. A higher p-value cutoff of $p \leq 0.10$ was noted for associations in bivariate analyses comparing the specified covariates with the respective exposures (partner discordances) as these were not the main relationships of interest. Multivariable logistic regression was conducted to assess predictors with HRAHPV; results are presented as odds ratios (OR) and adjusted odds ratios (aOR) with 95% confidence intervals (CI). Associations were based on aOR with 95% CI that did not include 1. Covariates were included in the model based on *a priori* knowledge and other factors reported in the literature to be associated with HPV infections which included age, HIV status, receptive anal sex, number of lifetime partners, and age at first sex.[13,21–25] Thus, multivariate models included gender identity, age, sexual orientation, city of participation, self-reported HIV status, receptive anal intercourse in the last 3 months, number of lifetime sex partners, and age at first sex. Separate models were executed for partner age-discordance, race/ethnicity discordance, and concurrent partner. All analyses were conducted using SAS v.9.4 (SAS Institute, Cary, NC).

Results

Of 1,033 total participants in the YMHPV study, 601 eligible participants were included in analyses for partner age discordance, 862 for partner race/ethnicity discordance, and 581 for partner with any concurrent partners. In the multivariate analyses, missing responses within other covariates decreased sample sizes to 451 for partner age discordance, 641 participants for partner race/ethnicity discordance, and 475 for concurrent partner analyses. Overall, participants most commonly identified as Hispanic/Latino (any race), male gender identity, gay sexual orientation, and from Los Angeles, with median age 23–24 years (IQR 21–25 years) (Table 1).

Partner age discordance

In analyses of partner age discordances among 601 participants (Table 1), most (484, 80.53%) reported that their last sex partner was within 10 years of their own age, 101 (16.81%) reported that their last sex partner was more than 10 years apart from their own age, and 16 (2.66%) of reported a partner of unknown age. In bivariate analyses, partner age discordance was associated with participant race/ethnicity, city of participation, gender identity, sexual orientation, age at first sex, last sex partner as transgender, any anal HPV, and HRAHPV ($p \leq 0.10$). HRAHPV prevalence was 54.96% among participants who had a partner within 10 years of age, 58.42% among those who had a partner with greater than 10 years of age, and 81.25% with a partner of unknown age ($p \leq 0.10$) (Figure).

In a multivariate model, participants reporting an age discrepancy of greater than 10 years with their most recent sex partner had similar odds of HRAHPV (aOR 0.89, 95% CI 0.51, 1.56) compared to those whose most recent sex partner was within 10 years of their own

age. However, participants whose partner's age was unknown had higher odds of HRAHPV (aOR 6.25, 95% CI 1.15, 34.08) compared to those whose most recent sex partner was within 10 years of their own age. HRAHPV was positively associated with participant identifying as gay, disclosing being HIV-positive, having had receptive anal intercourse in the past 3 months, having greater than 20 lifetime sex partners, and younger age at sexual debut (Table 2).

Partner race/ethnicity discordance

In analyses of partner race/ethnicity discordances among 862 participants (Table 1), about half (427, 49.54%) stated that their last sex partner was of a different race/ethnicity than their own, while 435 (50.46%) reported no race/ethnicity discordance. In bivariate analyses, partner race/ethnicity discordance was associated with participant race/ethnicity, gender identity, concurrent partner, and any anal HPV ($p \leq 0.10$). HRAHPV prevalence was 53.86% among participants who reported partner race/ethnicity discordance and 55.86% among those who reported no partner race/ethnicity discordance (p=0.56) (Figure).

In a multivariate model, participants whose most recent sex partner was of a different race/ethnicity had similar odds of HRAHPV (aOR 0.88; 95% CI 0.62, 1.24) compared to those whose partner was of the same race/ethnicity. HRAHPV was positively associated with participant age 22–26 years, identifying as gay, disclosing being HIV-positive, having had receptive anal intercourse in the past 3 months, having greater than 20 lifetime sex partners, and younger age at first sex (Table 2).

Partners with concurrent partners

In analyses of partners with concurrent partners among 581 participants (Table 1), most (464, 79.86%) believed that their last sex partner had other concurrent sex partners in addition to themselves, while 117 (20.14%) did not. In bivariate analyses, partner with concurrent partner was associated with participant gender identity, number of lifetime sex partners, receptive anal intercourse in the past 3 months, last sex partner as main partner, and last sex partner race/ethnicity discordance ($p \leq 0.10$). HRAHPV prevalence was 57.54% among participants reporting a partner with concurrent partners, and 51.28% among those not reporting a partner with concurrent partners (p=0.22) (Figure).

In a multivariate model, participants whose most recent sex partner also had another concurrent sex partner in addition to themselves had similar odds of HRAHPV (aOR 0.85, 95% CI 0.50, 1.42) compared to those whose partners did not. HRAHPV was positively associated with participant identifying as gay, disclosing being HIV-positive, having had receptive anal intercourse in the past 3 months, and having greater than 20 lifetime sex partners (Table 2).

Discussion

In this study of young MSM and TGW, discernable sexual mixing patterns with the most recent sex partner, including discordances in age, race/ethnicity, or concurrent sex partners, were not associated with having detectable HRAHPV infection. These null findings may be explained in part by the duration of high-risk HPV type persistence and the large number of

lifetime sex partners among our study population. In a previously published study, median duration of HPV infection was found to be 7.5 months for any HPV type, 7.2 months for high-risk HPV types, and 12.2 months for HPV type 16; clearance in men aged 18–30 years was longer than in other age groups.[31] Since HPV infection can persist for months to years, it might be more relevant to assess sexual mixing patterns with early sex partners or overall partners rather than most recent sex partner. In this study, participants were asked about characteristics of their most recent sex partner only, who may or may not have been the sex partner from whom HRAHPV infection was initially acquired.

In general, HRAHPV prevalence was very high (>50%) among all MSM and TGW included in our study, possibly overwhelming our ability to detect additional risk factors for this infection. Although having a partner of unknown age was associated with a higher odds of HRAHPV in our multivariate model, the results must be considered with caution as the sample size of participants with a partner of unknown age was small (n=16). Lack of knowledge of a partner's age may be a proxy for anonymous sex partners and risk behaviors that could put someone at higher risk for HRAHPV and other STIs. Furthermore, in a previous publication from this study, race/ethnicity was not associated with HPV prevalence for any HPV type or high-risk HPV types;[30] partner discordance by race/ethnicity may not be the most important risk factor for HRAHPV transmission in this population. Also, concurrent sex partners can increase risk for STIs, yet in our analysis, having a partner with concurrent partners did not increase odds of HRAHPV.

Other factors besides partner discordances were associated with HRAHPV in our analyses. We found higher odds of HRAHPV with recent receptive anal intercourse, self-reported positive HIV status, and higher number of lifetime sex partners, consistent with previous literature.[22–25] These findings are consistent with other published studies of STIs including HPV.[23,25,28]

This analysis is subject to several limitations. First, large numbers of missing responses to questions about partners could indicate bias, as participants who know their partners well and describe them might be at lower risk for STIs than those who do not. Second, results are probably not generalizable to lifetime sex partners contributing to HPV acquisition, since this cross-sectional study only asked questions about participants' most recent sex partner.

Additionally, the survey was conducted in English only and may not be generalizable to non-English speaking groups. Moreover, this study was conducted in health care clinics in urban settings in Los Angeles and Chicago, and generalizability to populations outside these regions might be limited. Furthermore, recall bias may affect self-reported data especially if participants do not disclose potentially stigmatizing behaviors; however, by limiting our data collection to recent behaviors, recall bias should be minimized. Additionally, use of computer-assisted interviews should reduce socially desirable responses and improve validity of the data. Finally, limited sample size may limit statistical power to identify associations.

These findings among MSM and TGW may be used as a foundation for future investigation of partner discordances and other aspects of sexual mixing and sexual network factors that

may be associated with anal HPV infections among MSM, including early sex partners. HRAHPV was prevalent among our study participants, suggesting a potentially beneficial role in this population for pre-exposure HPV vaccination. When this study was conducted in 2012–2014, soon after routine HPV vaccination for males was implemented in the United States, few study participants had been vaccinated against HPV. Since 2011, HPV vaccination has been routinely recommended for all U.S. adolescents, with catch-up vaccination recommended for MSM and TGW through age 26 years. In addition, catch-up HPV vaccination was recently recommended based on shared clinical decision-making for some adults through age 45 years who were not vaccinated as adolescents.[11] Reductions in prevalence of HPV infections, anogenital warts, and cervical precancers have been observed in multiple countries following HPV vaccine introduction in girls.[32] Increasing HPV vaccination coverage among all adolescents in the United States is expected to lead to a reduction of HRAHPV and subsequent reduction of anal cancer incidence among all young men and women with or without HIV, including MSM and TGW.

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Abbreviations

HPV	Human papillomavirus
STI	Sexually transmitted infection
MSM	Men who have sex with men
TGW	Transgender women
HIV	Human immunodeficiency virus
OR	Odds ratio
CI	Confidence interval
HRAHPV	High risk anal HPV
YMHPV	Young Men’s HPV
CASI	Confidential standardized computer-assisted interview
SD	Standard deviations
aOR	Adjusted odds ratios

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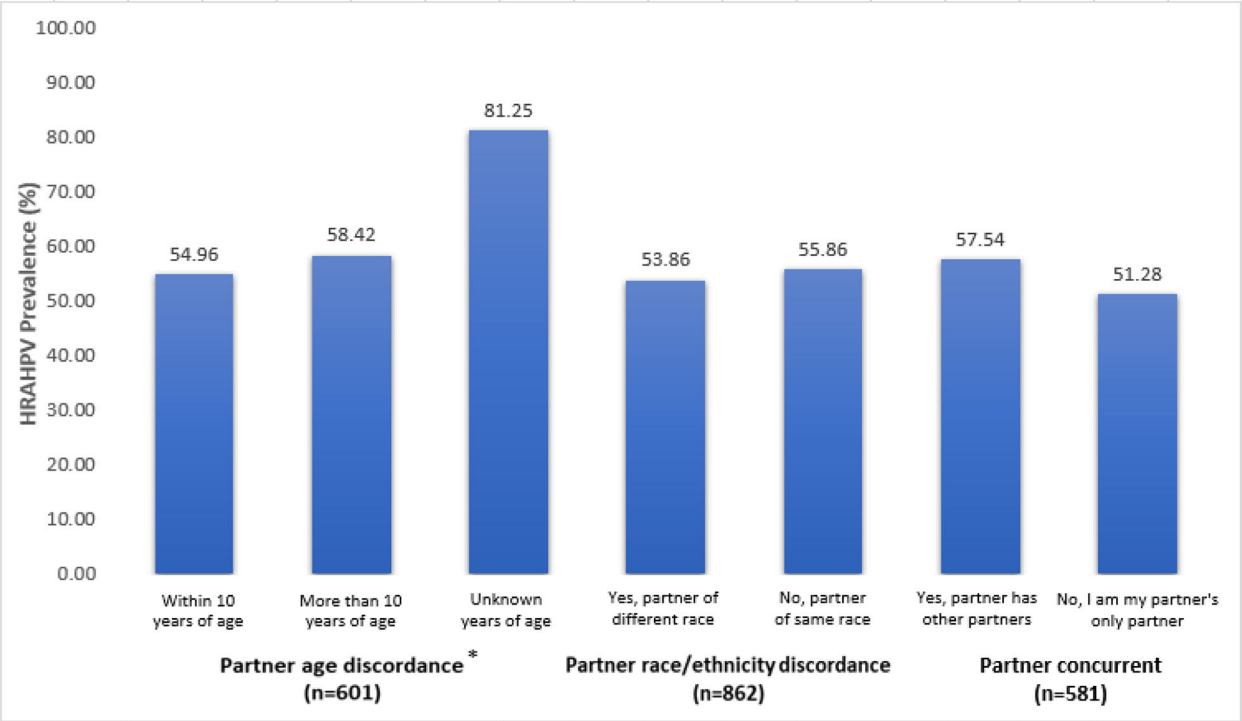

Figure.

High-risk anal HPV prevalence by sex partner discordances among young gay, bisexual, and other MSM and transgender women in 2 cities in the United States, 2012–2014.

*P ≤ 0.10. Unknown years of age only has 16 observations and may not be reflective of a true prevalence.

Table 1.

Demographics, sexual behaviors, characteristics of most recent sex partner, and anal HPV, by sex partner discordances, among young gay, bisexual, and other men who have sex with men and transgender women in 2 cities in the United States, 2012–2014

		Partner Age Discordance			Partner Race/Ethnicity Discordance			Concurrent Partner		
	Total N (%)	Partner age >10 years n (%)	Partner of unknown age n (%)	P-value	Total N (%)	Partnerrace/ ethnicity discordance n (%)	P-value	Total N (%)	Concurrent partner n (%)	P-Value
Total	601 (100)	101 (16.81)	16 (2.66)		862 (100)	427 (49.54)		581 (100)	464 (79.86)	
Demographics										
Age, years				--			--			--
Median	24.00	--	--		23.50	--		23.00	--	
IQR	21–25	--	--		21–25	--		21–25	--	
Age, years				0.80			0.87			0.44
18–21	174 (28.95)	27 (15.52)	4 (2.30)		232 (26.91)	116 (50.00)		162 (27.88)	128 (77.78)	
22–26	427 (71.05)	74 (17.33)	12 (2.81)		630 (73.09)	311 (49.37)		419 (72.12)	338 (80.67)	
Race/ethnicity				**0.03**			**<0.01**			0.63
Hispanic/Latino (any race)	225 (37.69)	36 (16.00)	4 (1.78)		332 (38.74)	163 (49.10)		223 (38.65)	177 (79.37)	
Non-Hispanic Black	110 (18.43)	12 (10.91)	8 (7.27)		164 (19.14)	64 (39.02)		95 (16.46)	74 (77.89)	
Non-Hispanic White	152 (25.46)	29 (19.08)	1 (0.66)		212 (24.74)	90 (42.45)		152 (26.34)	126 (82.89)	
Non-Hispanic Asian/Pacific Islander	55 (9.21)	13 (23.64)	0 (0)		73 (8.52)	43 (58.90)		54 (9.36)	40 (74.07)	
Multiracial/other	55 (9.21)	10 (18.18)	2 (3.64)		76 (8.87)	63 (82.89)		53 (9.19)	44 (83.02)	
City of participation				**<0.01**			0.36			0.63
Chicago, IL	190 (31.61)	27 (14.21)	11 (5.79)		265 (30.74)	125 (47.17)		178 (30.64)	140 (78.65)	
Los Angeles, CA	411 (68.39)	74 (18.00)	5 (1.22)		597 (69.26)	302 (50.59)		403 (69.36)	324 (80.40)	
Gender identity				**0.01**			**0.04**			**0.09**
Male	563 (94.30)	98 (17.41)	12 (2.13)		802 (93.47)	397 (49.50)		543 (93.78)	438 (80.66)	
Transgender female	23 (3.85)	2 (8.70)	4 (17.39)		40 (4.66)	15 (37.50)		28 (4.84)	18 (64.29)	
Other	11 (1.84)	1 (9.09)	0 (0)		16 (1.86)	12 (75.00)		8 (1.38)	6 (75.00)	
Sexual orientation				**0.03**			0.33			0.62
Gay/homosexual	409 (70.03)	72 (17.60)	10 (2.44)		609 (72.85)	302 (49.59)		419 (74.03)	340 (81.15)	
Bisexual	145 (24.83)	21 (14.48)	6 (4.14)		186 (22.25)	94 (50.54)		116 (20.49)	89 (76.72)	
Heterosexual	18 (3.08)	0 (0)	0 (0)		25 (2.99)	8 (32.00)		19 (3.36)	14 (73.68)	

		Partner Age Discordance			Partner Race/Ethnicity Discordance			Concurrent Partner		
	Total N (%)	**Partner age >10 years n (%)**	**Partner of unknown age n (%)**	**P-value**	**Total N (%)**	**Partnerrace/ ethnicity discordance n (%)**	**P-value**	**Total N (%)**	**Concurrent partner n (%)**	**P-Value**
Other/don't know	12 (2.05)	6 (50.00)	0 (0)		16 (1.91)	9 (56.25)		12 (2.12)	9 (75.00)	
Sexual behaviors and HIV status										
Age at first sex, years				**0.05**			0.57			0.38
≤15	176 (30.50)	33 (18.75)	9 (5.11)		243 (29.49)	126 (51.85)		158 (28.01)	130 (82.28)	
16–19	259 (44.89)	40 (15.44)	2 (0.77)		378 (45.87)	181 (47.88)		269 (47.70)	209 (77.70)	
>19	142 (24.61)	26 (18.31)	4 (2.82)		203 (24.64)	104 (51.23)		137 (24.29)	113 (82.48)	
Number of lifetime sex partners				0.40			0.45			**<0.01**
≤5	119 (23.33)	13 (10.92)	5 (4.20)		171 (23.49)	77 (45.03)		106 (20.08)	76 (71.70)	
6–10	76 (14.90)	14 (18.42)	2 (2.63)		119 (16.35)	55 (46.22)		88 (16.67)	60 (68.18)	
11–20	120 (23.53)	19 (15.83)	2 (1.67)		162 (22.25)	81 (50.00)		124 (23.48)	99 (79.84)	
>20	195 (38.24)	37 (18.97)	3 (1.54)		276 (37.91)	144 (52.17)		210 (39.77)	185 (88.10)	
Receptive anal intercourse, past 3 months				0.12			0.13			**0.02**
No	176 (30.93)	23 (13.07)	7 (3.98)		238 (29.02)	108 (45.38)		150 (26.60)	110 (73.33)	
Yes	393 (69.07)	74 (18.83)	8 (2.04)		582 (70.98)	298 (51.20)		414 (73.40)	341 (82.37)	
Self-reported HIV status				0.14			0.80			0.43
Negative or unknown	491 (89.44)	85 (17.31)	11 (2.24)		702 (89.43)	345 (49.15)		486 (90.50)	387 (79.63)	
Positive	58 (10.56)	6 (10.34)	3 (5.17)		83 (10.57)	42 (50.60)		51 (9.50)	43 (84.31)	
Characteristics of most recent sex partner										
Partner is main partner (e.g., spouse, boyfriend)				0.14			0.67			**<0.01**
Yes	260 (44.83)	34 (13.08)	6 (2.31)		394 (47.53)	196 (49.75)		304 (52.96)	210 (69.08)	
No	320 (55.17)	61 (19.06)	9 (2.81)		435 (52.47)	210 (48.28)		270 (47.04)	247 (91.48)	
Partner is transgender				**<0.01**			0.74			0.27
No	546 (92.07)	99 (18.13)	13 (2.38)		785 (92.68)	388 (49.43)		530 (92.82)	426 (80.38)	
Yes	47 (7.93)	1 (2.13)	3 (6.38)		62 (7.32)	32 (51.61)		41 (7.18)	30 (73.17)	
Partner age is discordant				--			**0.44**			0.56
Within 10 years of age	484 (80.53)	--	--		470 (80.62)	226 (48.09)		329 (81.23)	256 (77.81)	
More than 10 years of age	101 (16.81)	--	--		98 (16.81)	53 (54.08)		67 (16.54)	55 (82.09)	

		Partner Age Discordance			Partner Race/Ethnicity Discordance			Concurrent Partner		
	Total N (%)	**Partner age >10 years n (%)**	**Partner of unknown age n (%)**	**P-value**	**Total N (%)**	**Partnerrace/ ethnicity discordance n (%)**	**P-value**	**Total N (%)**	**Concurrent partner n (%)**	**P-Value**
Couldn't tell partners age	16 (2.66)	--	--		15 (2.57)	6 (40.00)		9 (2.22)	8 (88.89)	
Partner is race/ethnicity discordant				0.44			--			**0.04**
No	298 (51.11)	45 (15.10)	9 (3.02)		435 (50.46)	--		299 (52.27)	230 (76.92)	
Yes	285 (48.89)	53 (18.60)	6 (2.11)		427 (49.54)	--		273 (47.73)	229 (83.88)	
Partner has concurrent partnership(s)				0.68			0.04			
No	86 (21.23)	12 (13.95)	1 (1.16)		113 (19.76)	44 (38.94)		117 (20.14)	--	
Yes	319 (78.77)	55 (17.24)	8 (2.51)		459 (80.24)	229 (49.89)		464 (79.86)	--	
Anal HPV										
Any Anal HPV				**0.07**			**0.08**			0.17
No	168 (27.95)	24 (14.29)	1 (0.60)		247 (28.65)	134 (54.25)		164 (28.23)	125 (76.22)	
Yes	433 (72.05)	77 (17.78)	15 (3.46)		615 (71.35)	293 (47.64)		417 (71.77)	339 (81.29)	
HRAHPV				**0.10**			0.56			0.22
No	263 (43.76)	42 (15.97)	3 (1.14)		389 (45.13)	197 (50.64)		254 (43.72)	197 (77.56)	
Yes	338 (56.24)	59 (17.46)	13 (3.85)		473 (54.87)	230 (48.63)		327 (56.28)	267 (81.65)	
HPV 16				0.56			0.86			0.22
No	510 (84.86)	83 (16.27)	13 (2.55)		737 (85.50)	366 (49.66)		485 (83.48)	383 (78.97)	
Yes	91 (15.14)	18 (19.78)	3 (3.30)		125 (14.50)	61 (48.80)		96 (16.52)	81 (84.38)	
HPV 18				0.53			0.40			0.15
No	537 (89.35)	91 (16.95)	13 (2.42)		780 (90.49)	390 (50.00)		526 (90.53)	416 (79.09)	
Yes	64 (10.65)	10 (15.63)	3 (4.69)		82 (9.51)	37 (45.12)		55 (9.47)	48 (87.27)	

HPV = human papillomavirus; HRAHPV = high-risk anal HPV; HIV = human immunodeficiency virus Bold P-values ≤0.10

Table 2.

Adjusted odds ratios for associations with sex partner discordances among young gay, bisexual, and other men who have sex with men and transgender women in 2 cities in the United States, 2012–2014

	HRAHPV with Partner Age Discordance (n=451)*		HRAHPV with Partner Age Discordance (n=641)*		HRAHPV with Concurrent Partner (n=475)*	
	Adjusted OR**	95% CI	Adjusted OR**	95% CI	Adjusted OR**	95% CI
Partner age is discordant						
Within 10 years of age	1	Ref	--	--	--	--
More than 10 years of age	0.89	(0.51,1.56)	--	--	--	--
Couldn't tell partners age	6.25	(1.15,34.08)	--	--	--	--
Partner is race/ethnicity discordant						
No	--	--	1	Ref	--	--
Yes	--	--	0.88	(0.62,1.24)	--	--
Partner has concurrent partnership(s)						
No	--	--	--	--	1	Ref
Yes	--	--	--	--	0.85	(0.50,1.42)
Age, years						
18–21	1	Ref	1	Ref	1	Ref
22–26	1.56	(0.95,2.56)	1.54	(1.02,2.33)	1.39	(0.85,2.29)
City						
Los Angeles, CA	1	Ref	1	Ref	1	Ref
Chicago, IL	1.06	(0.65,1.73)	1.13	(0.75,1.71)	1.27	(0.77,2.10)
Gender identity						
Male	1	Ref	1	Ref	1	Ref
Transgender female	3.44	(0.60,19.76)	1.54	(0.52,4.54)	1.26	(0.32,4.97)
Other	1.73	(0.31,9.76)	1.15	(0.30,4.33)	5.29	(0.47,58.99)
Sexual orientation						
Bisexual	1	Ref	1	Ref	1	Ref
Gay/homosexual	2.42	(1.44,4.05)	1.84	(1.19,2.84)	2.81	(1.64,4.82)
Heterosexual	0.23	(0.02,2.20)	0.58	(0.14,2.44)	0.64	(0.11,3.87)
Other/don't know	4.42	(0.96,20.40)	4.82	(1.11,20.99)	18.56	(1.98,173.73)
Age at first sex, years						
≤15	2.33	(1.27,4.28)	1.81	(1.10,2.97)	1.78	(0.98,3.25)
16–19	2.65	(1.54,4.56)	1.55	(1.01,2.40)	1.51	(0.89,2.54)
>19	1	Ref	1	Ref	1	Ref
Number of lifetime sex partners						
≤5	1	Ref	1	Ref	1	Ref
6–10	1.58	(0.77,3.26)	1.27	(0.72,2.24)	1.91	(0.94,3.88)
11–20	1.44	(0.76,2.72)	1.38	(0.82,2.32)	1.72	(0.89,3.31)

	HRAHPV with Partner Age Discordance (n=451)*		HRAHPV with Partner Age Discordance (n=641)*		HRAHPV with Concurrent Partner (n=475)*	
	Adjusted OR**	95% CI	Adjusted OR**	95% CI	Adjusted OR**	95% CI
>20	2.05	(1.13,3.70)	1.84	(1.14,2.98)	2.36	(1.28,4.35)
Receptive anal intercourse, past 3 months						
No	1	Ref	1	Ref	1	Ref
Yes	2.25	(1.39,3.65)	2.97	(1.99,4.45)	3.42	(2.05,5.70)
Self-reported HIV status						
Negative or unknown	1	Ref	1	Ref	1	Ref
Positive	3.57	(1.34,9.54)	6.34	(2.52,15.96)	10.31	(2.76,38.44)

HRAHPV=high-risk anal HPV

*May not add to total because of missing data or non-responses

**Model adjusted for gender identity, age, sexual orientation, city of participation, self-reported HIV status, receptive anal intercourse in the last three months, number of lifetime sex partners, and age at first sex.