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HIV Risk and Protective Behaviors Among Men Who Have Sex with Men and Partners
Met Via Geosocial Networking Mobile App

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Boston College
2013

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An abstract of

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
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Abstract

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By Alexandra Savinkina

HIV disproportionately impacts men who have sex with men (MSM), with MSM accounting for approximately 60% of new HIV cases in the US each year. Major risk factors for HIV incidence in the MSM population include anal sex without a condom, high number of sexual partners, and intercourse with sexual partners of unknown status. With the advent of smartphones, MSM have been able to use geosocial networking (GSN) mobile apps, such as Tinder or Grindr, to meet sexual partners. MSM using these apps have been shown to have more sexual partners and a higher prevalence of STIs, as well as different HIV testing behavior; however, differences in the prevalence of unprotected anal intercourse in this population have not been shown and no national studies on the HIV risk factors of MSM who use GSN mobile apps has been done. The focus of this study was to characterize HIV risk with last sexual partner for MSM who met their last partner via mobile app, versus those who met online or in-person. Meeting via GSN mobile apps was associated with significantly higher likelihood of condom use during anal intercourse (OR 1.21), even accounting for factors such as main versus casual partnership and frequency of partnership. Those who met via GSN mobile app were also more likely to take preventative measures such as having been tested for HIV in the last 12 months and having ever used pre-exposure prophylaxis (PrEP). They were also more likely to have a larger number of sexual partners, report a higher proportion of last partnerships as casual partnerships, and not know the HIV status of their last partner. The co-occurrence of increased risk and protective behaviors among app-using MSM indicates that tailored intervention strategies may be appropriate, and such strategies should build on enhanced prevention behaviors while simultaneously addressing areas of likely increased risk.

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Introduction

In the US today, there are over one million people living with human immunodeficiency virus (HIV), with over 50,000 new infections every year. Although men who have sex with men (MSM) only account for about 2% of the US population, over 60% of all new HIV infections are among MSM, and 54% of all people living with HIV in the US are MSM (CDC, 2012).

Among MSM, condom-less anal intercourse is the predominant route of HIV transmission (Varghese, Maher, Peterman, Branson, & Steketee, 2002; Vittinghoff et al., 1999), and therefore instances of condom-less anal intercourse are suggestive of HIV risk. It has been shown that between 30 and 50% of MSM in the US engage in unprotected anal intercourse (Bruce, Harper, & Suleta, 2013; Lattimore, Thornton, Delpech, & Elford, 2011; Siegler, Sullivan, Khosropour, & Rosenberg, 2013). Along with usage of pre-exposure prophylaxis (PrEP) and reducing partner numbers, improving rates of condom usage during anal intercourse is one of the most effective ways of reducing incidence of HIV (Kramer et al., 2016) and this is the focus of many HIV interventions and programs.

Over time, the way that MSM choose to meet their sexual partners has been shifting, from in-person meetings to meeting via the Internet (Bull & McFarlane, 2000; Garofalo, Herrick, Mustanski, & Donenberg, 2007; Grov, Parsons, & Bimbi, 2007; Jennings et al., 2015) and online social networking (Beymer et al., 2014; Rendina, Jimenez, Grov, Ventuneac, & Parsons,

2014). Different venues to meet sexual partners have historically meant different risk factors; MSM who use the internet to meet sexual partners have been shown to have more sexual partners, and have a higher rate of unprotected anal intercourse with the partners they met online (Rosser, Miner, et al., 2009; Rosser, Oakes, et al., 2009). As venues for meeting partners have shifted, ways of implementing interventions, including recruitment, were also able to change with the population to more effectively reach those in need in the venues that they prefer, from in person interventions at gay nightclubs and bars (Barresi et al., 2010), to online recruitment and intervention for those who chose to meet partners on the internet (Lau et al., 2016).

With the advent of smartphones in the last 8 years, MSM have been able to meet sexual partners via geosocial networking (GSN) mobile apps such as Grindr, Tinder, or Jack'D. GSN app use is common, with estimates ranging from 10 to 34% of MSM using GSN apps to facilitate anonymous sexual encounters (Beymer et al., 2014),[(Rendina et al., 2014). GSN mobile apps work by accessing locational data on the app user, and providing a list of interested users located within a certain radius. Users can create a profile including pictures and blurbs about their personal interests and what they are looking for from app-facilitated encounters, and when users “match” with each other they can send messages via the app and are encouraged to set up a meeting. Due to the large number and variety of potential casual sexual partners and encounters, GSN mobile app use could have widespread effects on sexual health. Those who meet partners via GSN mobile apps have different risk factors compared to those who meet

partners in person, including a higher number of sexual partners and a higher prevalence of STIs (Beymer et al., 2014; Lehmiller & Ioerger, 2014). Those who used GSN apps also may have different HIV testing behaviors, with more frequent HIV testing and greater awareness of their HIV status (Rendina et al., 2014). There have been ambiguous results in comparing HIV risk in terms of anal intercourse without a condom, generally showing no significant difference between app-users and non-app users (Grosskopf, LeVasseur, & Glaser, 2014; Lehmiller & Ioerger, 2014), and no difference in HIV incidence between app-users and non-app users has been shown (Beymer et al., 2014). However, it has been shown that MSM are more likely to use condoms with a partner they met on Grindr than a partner met in a different way (Rice et al., 2012), suggesting that MSM may view GSN apps as a higher risk method of meeting sexual partners.

While smaller-scale or single-city studies have been done to assess GSN app use and the differing HIV risk factors related to it, there has not been a national study to address the question. Information on the differing risk profiles of GSN mobile app users and the differing HIV risks MSM take dependent on how they met their sexual partner could have implications for planning and implementing future targeted HIV interventions.

Methods

Data Source

Data for the study was taken from the 2014 American Men's Internet Survey (AMIS), an annual cross-sectional Internet survey that evaluates sexual behavior among MSM in the US. Participants were recruited through banner advertisements, both online and on GSN mobile apps, and through email blasts to potential participants. Recruited potential participants were given an electronic description of the study and an eligibility questionnaire and consent for those eligible. The survey instrument included a core questionnaire, and 3 subset questionnaires, with each participant randomized to one of the 3 subset questionnaires. To meet eligibility criteria, participants needed to be male, over the age of 18, MSM, and residents of the United States. In 2014, there were a total of 9,403 participants. Methods and protocol for AMIS have been described in more detail previously (Sanchez, Sineath, Kahle, S.J., & Sullivan, 2013).

Measures

Measures were taken directly from the AMIS dataset, previously described in more detail (Sanchez et al., 2013). The main outcome variable considered was anal intercourse without a condom at last sex defined as self-reported insertive and/or receptive anal intercourse without a condom at last encounter with last sexual partner. Condom use for "part of the time" was considered anal intercourse without a condom.

The main predictor variable was venue of meeting last sexual partner, which was subdivided into in person meeting, Internet meeting, or GSN mobile app meeting, depending on how the participant answered the question “How did you first meet [your last sexual partner]?”. Participants were classified as having met their last partner via GSN mobile app if they selected the option “Mobile app (such as Grindr, JackD or Scruff)”, as having met their last sexual partner via the Internet if they selected “Internet”, and as having met their last sexual partner in-person if they selected any of the options “work”, “school”, “house party”, “bar/club”, “circuit party or rave”, “public sex environment (such as a bath house, sex club, resort, cruising area, private sex party, or adult bookstore)”, or “place of worship (such as church, synagogue, or mosque)”.

Covariates considered in the analysis were demographic characteristics such as age (sub-divided into 4 categories, 15-24, 25-34, 35-44, and ≥ 45), race/ethnicity (Asian, Black/Africa American, Hispanic/Latino, White, or Other/Multiple), education level (high school or less, some college, and college or above), and household income (\$0-\$19,999, \$20,000-\$39,999, \$40,000-\$74,999, \$75,000+, and “prefer not to answer”). Other covariates considered included reported sexual orientation (straight, gay, bisexual, or prefer not to answer/don’t know), number of male sexual partners (categorical, 1, 2-5, 6-9, and 10+), status of partnership (whether the last sexual partner was considered a main partner or a casual partner), whether the last sexual encounter was a one-night stand, number of sexual partners in the last 12 months (including partners for anal sex only or anal and oral sex, categorized as 1 partner, 2-5 partners, 6-9

partners, or 10 or more partners), HIV status of the participant, whether HIV status of partner was known or unknown, HIV testing within the last year (yes/no), discordant status of partnership (determined by self-reported HIV status of self and last sexual partner by participant), PrEP use (ever or no), and alcohol or drug use before last sexual encounter, all of which were self-reported by the participants in the survey.

Exclusion Criteria

Participants must have reported having anal intercourse (either insertive or receptive) at last sexual encounter to be included in the analysis. Participants were excluded from the analysis if they were missing information for condom use at last sexual encounter or chose “don’t know” or “prefer not to answer”.

Participants were also excluded if they were missing information for venue of meeting last sexual partner, or if they chose “don’t know” or “prefer not to answer”. Participants were not excluded from the analysis for having missing information for other covariates of interest.

Data Analysis

The analyses for this paper were generated using SAS (Cary, NC). The initial number of participants (n=9,403) was limited according to exclusion criteria (n=6,286).

Bivariate analysis was performed using SAS PROC FREQ to assess demographic and sexual characteristics of the study population, by venue of meeting, and Chi-square statistics were used to determine statistical significance. Further bivariate analysis was used to assess the relationship between venue of

partner meeting and covariates of interest, using SAS PROC LOGISTIC.

Multivariate analysis was performed using SAS PROC LOGISTIC to determine associations between venue of partner meeting and covariates, controlling for the demographic characteristics of age, race and income.

A final adjusted logistic regression was run with anal intercourse with a condom as the outcome variable and venue for meeting last partner as the main predictor (with in-person meeting as the reference category), controlling for certain demographic characteristics as well as selected additional covariates chosen due to potential association with venue for partner meeting. Results were reported at the $p=0.05$ level of significance. Collinearity between potential covariates and goodness of fit of the final model were assessed.

Results

Demographics and Sexual Characteristics

The total sample was made up of 6,286 participants (Table 1). 67.6% of participants were over the age of 35; 72.3% were white, 15.3% were Hispanic, and 4.6% were Black/African American. Over 50% of the sample had at least a college degree, with only about 10% with a high school education or less. Over 50% of the sample made over \$40,000/year. Of the participants, 79.0% of participants considered themselves gay. In reporting number of male sexual partners in the last 12 months, 22.4% reported one, 29.1% reported 2-5, 10.9% reported 6-9, and 26.7% reported 10 or more.

Among participants, 33.4% (n=2,101) met their last sexual partner via GSN mobile app, 25.5% (n=1,602) met their last sexual partner via the Internet, and 41.0% (n=2,583) met their last sexual partner in person (Table 1). Those who met their last partner via GSN mobile app were generally younger (55.4% over 35), and those who met on the Internet were older (79.5% over 35). Those who met their last partner via GSN mobile app were slightly more diverse than the overall study population, with 69.3% being white, 16.9% Hispanic, and 5.2% Black/African American. Those who met their last partner via GSN mobile app reported slightly lower salaries on average (30.9% making \$75,000 or more, compared to 40.4% among internet users, and 39.3% among those who met their last partner in person). Among those who met their last partner via GSN mobile app, 10.2% reported only one male sexual partner in the last 12 months, and

36.5% reported 10 or more, as compared to 24.8% among those who met online and 19.8% among those who met their last partner in person.

Associations with Venue of Meeting

Among all participants, 73.3% reported having anal intercourse without a condom with their last sexual partner. Those who met via GSN mobile app reported anal intercourse without a condom in 65.5% of cases, compared to 77.7% among those who met online and 76.7% among those who met in-person.

Those who met their last partner via GSN mobile app were less likely to claim that partner as a main partner than those who met online or in-person (OR= 0.41, 95% confidence interval (CI) 0.352-0.477; OR=0.26, 95% CI 0.227-0.299, respectively) (Table 2). Those who met their last partner via GSN mobile app were also more likely to report that last sexual encounter as a one-night stand than those who met online or in-person (OR=2.21, 95% CI 1.838-2.645; OR=2.29, 95% CI 2.484-3.460, respectively). Those who met their last partner via GSN mobile app were slightly more likely to report alcohol use before sex than those who met online (OR=1.40, 95% CI 1.198-1.627), but less likely than those who met in-person (OR=0.71, 95% CI 0.626-0.806). Those who met their last partner via GSN mobile app were more likely to report drug use before sex than those who met online (OR=1.37, 95% CI 1.084-1.733). Those who met their last partner via GSN mobile app were more likely to have been tested for HIV in the last 12 months than those who met online or in-person (OR=1.44, 95% CI 1.245-1.671; OR= 1.25, 1.095-1.420, respectively), though there was no significant difference in HIV prevalence among groups. Those who met via app were more

likely to not know the HIV status of their partner than those who met online or in-person (OR=1.51, 95% CI 1.240-1.835; OR=1.22, 95% CI 1.033-1.436, respectively), and they were more likely to be in discordant/serostatus undetermined partnerships than those who met online (OR=1.39, 95% CI 1.157-1.671). Those who met their last partner via mobile app were more likely than those who met online or in person to be using PrEP (OR=1.78, 95% CI 1.259-2.518; OR=1.95, 95% CI 1.436-2.646, respectively). Those who met their last partner via mobile app were more likely to have 10 or more partners than those who met their last partner in person or online (OR=5.43, 95% CI 4.500-6.556; OR=3.78, 95% CI 3.083-4.641, respectively).

Associations with Anal Intercourse with a Condom

Those who met their last partner via GSN mobile app were more likely to use a condom during anal intercourse than those who met their last partner via the internet or in-person (reference)(OR=1.74, CI 1.53-1.98), and this relationship remained after adjustment for age, race, household income, partnership type, frequency of partnership, HIV status, history of HIV testing within the last 12 months, and alcohol and drug use before last sexual encounter (adjusted OR=1.22, 95% CI 1.02-1.46, $p=0.03$) (Table 3).

Participants were less likely to report anal intercourse with a condom if their last partner was a main partner (adjusted OR=0.30, 95% CI 0.25-0.36), if the participant was HIV positive (adjusted OR=0.61, 95% CI 0.48-0.77), or if they used drugs before sex (adjusted OR=0.45, 95% CI 0.34-0.60). Participants were more likely to report sex with a condom if their last sexual partner was thought to

be a one-night stand (OR=1.25, 95% CI 1.02-1.53). Those who reported anal intercourse with a condom were also more likely to be younger, with condom-protected anal intercourse less likely in older age groups.

Discussion

The goal of this study was to analyze, in a national cross-sectional survey, HIV risk factors of MSM who used a GSN mobile app to meet their last sexual partner, and to determine whether this population differed from those who met partners in person or online. As venues of meeting sexual partners shifted from in person meetings to Internet meetings, HIV risk factors shifted as well. Risk factors such as partner number, likelihood of casual sex, and “barebacking” (anal sex without a condom) have been shown to be higher among men who met online versus in person (Abara, Annang, Spencer, Fairchild, & Billings, 2014; Rosser, Miner, et al., 2009; Rosser, Oakes, et al., 2009), possibly due to the increased ease of meeting a large number of partners. GSN mobile apps potentially offer an even easier way of meeting high numbers of proximally located sexual partners, which could raise the overall number of sexual partners, the number of interactions per partner, and further could facilitate risk-taking behavior by allowing for selection of partners with mutually shared preferences, such as “bareback” sex.

MSM who used a GSN mobile app to meet their last sexual partner showed a comparative increase in some risk behaviors with that partner, including a lower likelihood of reporting the partner as a “main” partner, and a higher likelihood of reporting no future plans with the partner (“one-night stand”). MSM who used a GSN mobile app to meet their last sexual partner also reported a lower likelihood of knowing the HIV status of that sexual partner, though many

GSN mobile apps allow for self-disclosure, and the disclosure of HIV+ serostatus, PrEP use, and undetectable viral load (UVL) status are not uncommon (Newcomb, Mongrella, Weis, McMillen, & Mustanski, 2016). Further research on serodisclosure over GSN mobile apps, as well as perception of that disclosure, would provide benefit. MSM who used a GSN mobile app to meet their last sexual partner also reported a higher overall number of sexual partners within the last 12 months, a known risk factor for HIV transmission (Varghese et al., 2002; Vittinghoff et al., 1999), and use of the GSN mobile app itself could be seen as an HIV risk behavior due to the increased availability of partners.

Despite the higher risk behaviors seen among the group, MSM who used a GSN mobile app to meet their last sexual partner reported a higher likelihood of having had an HIV test within the past 12 months, and a higher likelihood of having ever tried PrEP. MSM who used a GSN mobile app to meet their last sexual partner also appear to be taking more precautions against HIV with that partner than those MSM who met their last partner in other ways, shown by their more than 20% higher usage of condoms during their last anal intercourse. This could potentially be because they see these partners as being “riskier”, or more likely to be HIV positive; past research has shown that HIV-negative MSM use condoms more often with those partners they perceive to be more likely to be HIV-positive regardless of whether they know their HIV status or not (Eaton, Kalichman, O'Connell, & Karchner, 2009; Wei et al., 2011).

Several factors from the data support the theory that a higher perception of risk in partners met through the GSN mobile app venue can account for higher

condom use. The lower likelihood of reported “main” partners, and higher likelihood of “one-night stand” partners within the GSN mobile app group lends credence to the idea that condom use may have to do with the perception of risk of the sexual partner. Overall, those men who considered their last partner a “main” partner were 3 times less likely to use a condom during intercourse, and those who considered the partner a one-night stand were 25% more likely to use a condom, which is consistent with past research (Newcomb, Ryan, Garofalo, & Mustanski, 2014). Still, the trend of higher condom use among MSM who used a GSN mobile app to meet their last sexual partner remains even after controlling for type and frequency of partnership, which may mean that partners met through GSN mobile apps are potentially being viewed as riskier than typical one-time sexual partners met from more conventional sources such as a bar or even through the internet.

Understanding the reasoning behind the increased risk and protective behaviors among MSM who meet sexual partners using GSN mobile apps can have implications in terms of future interventions. It appears that the GSN mobile app using group shows a higher willingness to use condoms, at least in terms of sexual partners met via GSN mobile app, as well as an apparent willingness to use PrEP. This suggests that this population may be better informed in HIV protective behaviors and more open to interventions aimed at HIV prevention, and also that interventions should be made readily available to this group, including PrEP.

A common theme of HIV intervention research is seeking to leverage through online and app-based resources to enhance HIV prevention (Brennan et al., 2015; Levy et al., 2015; Rosser, Miner, et al., 2009), and online prevention techniques have shown to be effective in improving correct condom usage, HIV and STI testing, and HIV knowledge (Brennan et al., 2015). App-based interventions have shown great potential for use, as well, especially among those who do not have regular access to healthcare and insurance (Levy et al., 2015). Our findings regarding GSN mobile apps and sexual partners indicate that MSM who used a GSN mobile app to meet their last sexual partner are also more open to HIV prevention interventions, and this may be a great opportunity to use the very venue they use to meet sexual partners to help reduce HIV risk within the group.

Limitations and Further Research

Due to the initial study design, we were limited to only information on how the participant met their last partner, because we did not have data on how often the participants used GSN mobile apps to meet sexual partners. This likely led to misclassification, as venue for meeting last sexual partner may not be the main venue used by the participant. This is especially important in regards to findings outside of the last sexual partnership, like HIV testing within the last 12 months, ever having used PrEP, and number of male sexual partners within the last 12 months, and the potential misclassification needs to be taken into account when interpreting the associations between these variables and venue of meeting last partner as it could be biasing the results and the direction of bias cannot be

determined. It is likely, however, that the reported venue for meeting last sexual partner is, if not the main venue used by the participant, a venue used regularly enough to be reported, and as our sample size is relatively large the results should hold valid.

As all study information was self-reported, general misclassification is plausible, especially in terms of sensitive information such as sexual behavior. Study participants may not want to self-report answers that they know are considered less acceptable, for instance anal intercourse without a condom. However, effect of misclassification could be mitigated by the anonymity inherent in the study design. In terms of the outcome measure, over 70% of the sample reported anal intercourse without a condom, which is higher than the rates seen in other studies. Also, as we do not expect self-report of condom usage to differ according to venue of meeting last sexual partner, and we would expect the specificity of the measure to be 100%, any misclassification would not be expected to cause bias.

Our sample was made up of largely affluent (61.9% making over \$40,000) and white (72.3%) men, while the HIV/AIDS burden is largely among poorer minority individuals. However, income and race did not appear to have a significant effect within our analysis.

Further research, including quantitative as well as qualitative studies, should look at overall trends in partnership initiation and associated risk factors, as there appear to be differences in risk among the differing venues. Of especial import may be research into the reasons for different rates of preventative

methods, including condom usage as well as PrEP usage and more regular HIV testing, undertaken by the GSN mobile app users. This would help to more fully understand the population and the areas of need in terms of future HIV prevention interventions.

Conclusion

MSM who used a GSN mobile app to meet their last sexual partner appeared to have both increased rates of HIV risks and increased rates of HIV preventative behaviors than those who met their last sexual partner via a different venue. It is unclear from the present study whether this is due to higher perceived risk within the mobile app-facilitated partnership or whether it is due to inherent differences in the GSN mobile app using population. More research is needed in this area, as understanding this emerging group among the MSM population could lead to more opportunities to targeted HIV interventions.

Table 1. Demographic and sexual characteristics of the study population (N=6,286), by venue for meeting last sexual partner.

	All MSM* (N=6286)		Met Via Mobile App (N=2,101)		Met Online (N=1,602)		Met In Person (N=2,583)		p-value**
	No.	%	No.	%	No.	%	No.	%	
Demographics									
Age									<0.001
15-24	1,053	16.7%	494	23.5%	138	8.6%	421	16.3%	
25-34	985	15.7%	443	21.1%	190	11.9%	352	13.6%	
35-44	1,440	22.9%	512	24.4%	362	22.6%	566	21.9%	
≥45	2,808	44.7%	652	31.0%	912	56.9%	1,244	48.2%	
Race/ethnicity									0.01
Asian	150	2.4%	65	3.1%	43	2.7%	42	1.6%	
Black or African American	287	4.6%	109	5.2%	62	3.9%	116	4.5%	
Hispanic/Latino	964	15.3%	356	16.9%	211	13.2%	397	15.4%	
White	4,546	72.3%	1,458	69.4%	1,195	74.6%	1,893	73.3%	
Other/Multiple	271	4.4%	94	4.5%	71	4.4%	106	4.1%	
Educational Level									0.09
High School or Less	621	9.9%	213	10.1%	137	8.6%	271	10.5%	
Some College, Associate's Degree, or Technical Degree	2,057	32.7%	669	31.8%	509	31.8%	879	34.0%	
College, post graduate or professional school	3,556	56.6%	1,209	57.5%	937	58.5%	1,410	54.6%	
Household Income									<0.001
\$0 to \$19,999	682	10.8%	268	12.8%	143	8.9%	271	10.5%	
\$20,000 to \$39,999	1,153	18.3%	446	21.2%	263	16.4%	444	17.2%	
\$40,000 to \$74,999	1,579	25.1%	530	25.2%	417	26.0%	632	24.5%	
\$75,000 or more	2,312	36.8%	650	30.9%	648	40.4%	1,014	39.3%	
Prefer not to answer/don't know	255	4.1%	85	4.0%	60	3.7%	110	4.3%	

*Men who have sex with men

**Chi-square test statistic

Table 1 (cont). Demographic and sexual characteristics of the study population (N=6,286), by venue for meeting last sexual partner.

	All MSM* (N=6286)		Met Via Mobile App (N=2,101)		Met Online (N=1,602)		Met In Person (N=2,583)		p- value**
	No.	%	No.	%	No.	%	No.	%	
Sexual Characteristics									
Reported Sex With a Condom, last partner									
No	4,602	73.2%	1,376	65.5%	1,244	77.7%	1,982	76.7%	<0.001
Yes	1,684	26.8%	725	34.5%	358	22.3%	601	23.3%	
Sexual Orientation									
Straight	24	0.4%	4	0.2%	10	0.6%	10	0.4%	0.57
Gay	4,964	79.0%	1,635	77.8%	1,275	79.6%	2,054	79.5%	
Bisexual	775	12.3%	267	12.7%	197	12.3%	311	12.0%	
Prefer not to answer/don't know	34	0.5%	8	0.4%	9	0.6%	17	0.7%	
Number of Male Sexual Partners, last 12 months									
1	1,409	22.4%	214	10.2%	419	26.2%	776	30.0%	<0.001
2 - 5	1,832	29.1%	566	26.9%	472	29.5%	794	30.7%	
6 - 9	682	10.9%	294	14.0%	159	9.9%	229	8.9%	
10+	1,676	26.7%	767	36.5%	397	24.8%	512	19.8%	

*Men who have sex with men

**Chi-square test statistic

Table 2. Bivariate and multivariate logistic regression analysis of venue of meeting last sexual partner (in-person meeting as reference) and potential behavioral covariates of interest.

Last partner met via mobile app versus in-person (ref)					
	Unadjusted OR	Bivariate p-value	Adjusted* OR	95% CI	Multivariate p-value
Status of Partner					
Main partner (n=3,115)	0.27	<0.0001	0.26	0.227- 0.299	<0.0001
Casual partner (n=2227)	1.00	ref			
Frequency of Sexual Interaction					
One-night stand (n=1,036)	2.29	<0.0001	2.29	2.484-3.460	<0.0001
More than once (n=4,447)	1.00	ref			
Alcohol Use					
Alcohol use before sex (n=2,105)	0.72	<0.0001	0.71	0.626-0.806	<0.001
No alcohol use before sex (n=4,196)	1.00	ref			
Drug Use					
Drug use before sex (n=635)	1.05	0.6223	1.09	0.899-1.326	0.3759
No drug use before sex (n=5,666)	1.00	ref			
HIV Testing					
Participant tested in last 12 months (n=2,866)	1.24	0.0010	1.25	1.095-1.420	0.0009
Not tested in the last 12 months (n=2,464)	1.00	ref			
Participant HIV+ Status					
Positive (n=762)	0.95	0.5703	1.07	0.878-1.293	0.6494
Negative/Unknown (n=4,891)	1.00	ref			
Partner's HIV Status					
Unknown (n=1,031)	1.24	0.0076	1.22	1.033-1.436	0.019
Known (n=3,144)	1.00	ref			
Discordant Status**					
HIV status discordant (n=1,235)	1.11	0.1994	1.09	0.928-1.273	0.3033
HIV status concordant (n=2,520)	1.00	ref			
PrEP Use***					
Participant used PrEP (n=261)	1.77	0.0001	1.95	1.436-2.646	<0.0001
Participant did not use PrEP (n=2,788)	1.00	ref			

*Adjusted for age, race, and income

**Discordant status defined by participant reporting differing HIV serostatus for self and last sexual partner, including if sexual partner status unknown.

***Defined as "ever having used pre-exposure prophylaxis before having sex".

Table 2. (cont). Bivariate and multivariate logistic regression analysis of venue of meeting last sexual partner (in-person meeting as reference) and potential behavioral covariates of interest.

Last partner met via mobile app versus online (ref)					
	Unadjusted OR	Bivariate p-value	Adjusted* OR	95% CI	Multivariate p-value
Status of Partner					
Main partner (n=3,115)	0.42	<0.0001	0.41	0.352- 0.477	<0.0001
Casual partner (n=2227)	1.00	ref			
Frequency of Sexual Interaction					
One-night stand (n=1,036)	2.29	<0.0001	2.21	1.838- 2.645	<0.0001
More than once (n=4,447)	1.00	ref			
Alcohol Use					
Alcohol use before sex (n=2,105)	1.38	<0.0001	1.40	1.198-1.627	<0.001
No alcohol use before sex (n=4,196)	1.00	ref			
Drug Use					
Drug use before sex (n=635)	1.35	0.0087	1.37	1.084-1.733	0.0089
No drug use before sex (n=5,666)	1.00	ref			
HIV Testing					
Participant tested in last 12 months (n=2,866)	1.41	<0.001	1.44	1.245-1.671	<0.001
Not tested in the last 12 months (n=2,464)	1.00	ref			
Participant HIV+ Status					
Positive (n=762)	0.83	0.069	0.96	0.781-1.191	0.7352
Negative/Unknown (n=4,891)	1.00	ref			
Partner's HIV Status					
Unknown (n=1,031)	1.58	<0.001	1.51	1.240-1.835	<0.001
Known (n=3,144)	1.00	ref			
Discordant Status**					
HIV status discordant (n=1,235)	1.42	<0.001	1.39	1.157-1.671	0.0004
HIV status concordant (n=2,520)	1.00	ref			
PrEP Use***					
Participant used PrEP (n=261)	1.47	0.0191	1.78	1.259-2.518	0.0011
Participant did not use PrEP (n=2,788)	1.00	ref			

*Adjusted for age, race, and income

**Discordant status defined by participant reporting differing HIV serostatus for self and last sexual partner, including if sexual partner status was unknown.

***Defined as "ever having used pre-exposure prophylaxis before having sex".

Table 3: Multivariate logistic model for the relationship between condom sex with last sexual partner and venue of meeting last sexual partner (via mobile app, the internet, or in-person*), adjusted for appropriate covariates.

	Unadjusted OR	Adjusted OR	95% CI	p-value
Venue for Meeting				
In-person Meeting	1.00	1.00	ref.	
App Meeting	1.74	1.22	1.019-1.456	0.0308
Internet Meeting	0.95	0.89	0.733-1.084	0.2488
Age				
15-24	1.00	1.00	ref.	
25-34	0.74	0.69	0.532-0.894	0.005
35-44	0.56	0.56	0.438-0.727	<0.0001
≥45	0.58	0.58	0.459-0.737	<0.0001
Race				
White	1.00	1.00	ref.	
Asian	1.54	1.28	0.793-2.070	0.7905
Black or African American	1.34	1.28	0.900-1.827	0.7220
Hispanic/Latino	1.41	1.35	1.095-1.658	0.3103
Other/Multiple	1.21	1.20	0.843-1.694	0.9142
Household Income				
\$0 to \$19,999	1.00	1.00	ref.	
\$20,000 to \$39,999	0.99	0.82	0.621-1.090	0.4193
\$40,000 to \$74,999	0.88	0.88	0.668-1.147	0.9191
\$75,000 or more	0.77	0.86	0.658-1.124	0.7363
Prefer not to answer/don't know	1.37	0.86	0.551-1.350	0.8906
Type of Partnership				
Casual partner	1.00	1.00	ref.	
Main partner	0.28	0.30	0.253-0.362	<0.0001
Expected Frequency of Relationship				
More than once	1.00	1.00	ref.	
One night stand	2.98	1.25	1.023-1.530	0.0293
Serostatus				
HIV-	1.00	1.00	ref.	
HIV+	0.73	0.61	0.483-0.770	<0.0001
HIV Test in Last 12 Months				
No	1.00	1.00	ref.	
Yes	1.08	0.99	0.847-1.146	0.8436
Alcohol Use Before Sex				
No	1.00	1.00	ref.	
Yes	1.06	1.14	0.974-1.338	0.1025
Drug Use Before Sex				
No	1.00	1.00	ref.	
Yes	0.60	0.45	0.340-0.599	<0.0001

*reference group

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