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Engagement in group sex among geosocial networking (GSN) mobile application-using men who have sex with men (MSM)

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ABSTRACT

Background: Men who have sex with men (MSM) remain the group most affected by the HIV epidemic in the United States. At least one-quarter of MSM report engagement in group sex events (GSEs), which can pose a risk for HIV transmission and acquisition. In this study, we sought to identify event-level correlates of sexual and drug use behaviors at GSEs to better inform prevention activities.

Methods: For this study, we recruited participants via banner and pop-up advertisements placed on a geosocial networking mobile phone application for MSM to meet.

Results: Of the 1,997 individuals who completed the study screener, 36.0% reported participating in at least one GSE in the prior year. In multivariable logistic regression, attendance at a GSE in the past year was significantly associated with older age, full/part time employment, and being HIV-positive. Of the men who attended a GSE, more than half reported condomless anal sex (CAS) with at least one of their partners (insertive: 57.7%; receptive: 56.3%). MSM who indicated drug use had significantly higher odds of having insertive CAS (odds ratio (OR) = 2.45; 95% confidence interval (CI): 1.37, 4.39) and receptive CAS (OR = 3.60; 95% CI: 1.96, 6.63) at their last GSE.

Conclusions: The high prevalence of HIV-positive MSM engaging in group sex, coupled with their greater odds of CAS, poses a significant risk for HIV/STI transmission within the group sex setting. More research is needed to determine patterns of condom use at these events, and whether seroadaptive behaviors are driving CAS.

INTRODUCTION

Men who have sex with men (MSM) remain the group most affected by the HIV epidemic in the United States. Male-to-male sexual contact represented 80.4% of the newly diagnosed HIV cases among adult and adolescent males in 2012, with most new cases occurring among Black, White, and Hispanic MSM (1).

Most research into the drivers of HIV among MSM has focused on individual (race/ethnicity, socioeconomic status, etc.) and dyadic characteristics (condom usage, sexual positioning, etc.). These factors become increasingly more important when investigating the phenomenon of group sex events (GSEs), which can include both threesomes and instances where an individual has sex with at least three other people during the same sexual encounter. Among MSM, engagement in GSEs is prevalent. One study in Washington, DC found that 27.2% of venue-attending MSM had participated in at least one GSE in the prior year (2). A national study that used online recruitment from a sex-seeking website reported that 45.2% of MSM had attended a sex party (specifically, an organized or themed GSE) in the past year (3).

Men who engage in behaviors such as group sex and intensive sex partying (ISP) are considered to be sexually adventurous (4, 5), meaning they pursue opportunities that will maximize their pleasure with few inhibitions. Research has shown that the pleasure-seeking behaviors of these sexually adventurous MSM place them at increased risk for becoming HIV infected (4). Subsequent studies have built on this finding by showing that MSM who attend GSEs tend to engage in high-risk sex and drug use behaviors that may place them at higher risk

for becoming HIV-infected. More than one-fifth of MSM recruited online from a sexual networking site reported ever attending a bareback-themed sex party where condoms were intentionally not used during anal sex (3). Another study from 2012 found that 54.7% of MSM did not use condoms consistently with anal sex partners--21.7% only used them with some partners and 33.0% did not use them with any partners (2). A third study reported that 35.5% of men attending a spontaneous GSE engaged in insertive condomless anal sex (CAS) and 43.3% engaged in receptive CAS (6). These studies mirror others that found between one-third and one-half of group sex participants had engaged in CAS at these events (7-9). Comparatively, rates of CAS among MSM at GSEs are higher than those in dyadic sexual relationships between men; a national study reported that 37% of MSM engaged in CAS with a main partner and 25% with a casual partner (10). While informative, many of these GSE studies fail to capture the event-level characteristics that may be predictive of participating in CAS (e.g., location of encounter, number of participants).

In general, MSM who attend GSEs are more likely to have used drugs than non-attendees, whether at the event or elsewhere. MSM who had attended a GSE had 2.6 times the odds of using non-injection drugs compared with those who had not been at a GSE, with significant associations found for use of crystal meth (odds ratio (OR) = 8.28; 95% confidence interval (CI): 3.14, 21.8), downers (OR = 7.07; 95% CI: 2.82, 17.7), and poppers (OR = 2.51; 95% CI: 1.50, 4.20) (2). Regarding drug use at the event, 51.3% of GSE participants in an Australian study of MSM reported illicit substance use, with most reporting use of poppers and ecstasy (11). Similarly high numbers were found in a US study investigating spontaneous group sex and organized sex parties, with high rates of cocaine (8.4% and 4.1%, respectively), crystal meth (15.6% and 6.8%), ecstasy (7.3% and 4.1%), GHB (5.9% and 3.2%), marijuana (27.9% and

21.0%), and popper use (38.3 and 33.8%) being used at the most recent spontaneous group sex or organized sex party (6).

Therefore, due to the potential for HIV acquisition and transmission at GSEs, additional research is necessary to provide additional information on event-level characteristics of GSEs that could facilitate the spread of HIV through the MSM population. By gaining a deeper understanding of the contexts in which CAS and drug use may occur, we can better target prevention activities for GSEs based on the characteristics that are found to be most associated with risk behaviors. To answer these questions, we surveyed men recruited via geosocial networking (GSN) mobile phone applications. This paper will further clarify the behaviors that take place at GSEs, detail event-level characteristics of GSEs that may contribute to risk, and identify areas for potential future intervention.

METHODS

We recruited participants via banner and pop-up advertisements placed on a GSN mobile phone application for MSM to meet. The campaign served the dual purpose of recruiting participants for a randomized clinical trial (RCT; not reported here) and to collect survey data from MSM that were ineligible for the RCT. Once the RCT recruitment targets were met, survey participation was offered to all MSM. Advertisements ran from November 2014 through February 2015 and described a survey that provided an opportunity to provide input to better understand and serve the health needs of the LGBTQ community. Advertisements were shown throughout the US, with pop-up ads shown 5 times—each time shown the first time a user logged onto the application within the scheduled 24-hour advertising period. In addition to pop-up messages, we ran banner advertisements continuously during the period. No incentives for participation were provided for completing the surveys, although depending on responses

participants may have been routed to the RCT that provided compensation. This study was approved by the Northwestern University Institutional Review Board.

Those who clicked on advertisements were taken to an eligibility screener administered online on their mobile device's browser (outside of the app). A total of 4,783 individuals clicked the advertisements and 2,932 (61.3%) consented and started the screener. Of those, 801 (27%) were ineligible for survey participation because of demographic characteristics (female or under 18 years of age), provisional eligibility for the RCT (age 18-29 years, male sex assigned at birth and male gender identity, not in a serious monogamous relationship lasting more than 6 months, had sex with a male, had CAS in prior 6 months, and HIV-negative or unknown status), or failure to complete the screener. Participants who met the RCT eligibility criteria but who either were not interested in participating or who refused to consent for the RCT were re-routed into the surveys.

In data cleaning, participants were recoded as ineligible if they were identified as a duplicate participant. Potential duplicates were identified based on matching on 10 demographic characteristics (e.g., age +/-1 year, ZIP code). From that analysis, 53 cases in which participants potentially completed the survey more than once were identified for further examination on additional variables (survey date and completion time, survey responses), resulting in 33 cases that were subsequently removed as duplicates. The remaining 2,098 participants were routed to various surveys; 1,997 (95.2%) completed the screener question regarding engagement in group sex and were included in the first portion of the analysis.

Of the 722 participants who reported engaging in group sex in the past year, 473 (65.5%) were offered the opportunity to complete the survey associated with the current study and others were routed to other surveys. Two participants were dropped due to their report of an unrealistic

number of sex partners at last GSE (i.e., 63,104), 12 participants who only reported sex with two other partners were dropped (research has indicated significant differences in behavioral characteristics between threesomes and having sex with at least three partners (6)), and 7 participants did not complete the entire section, resulting in an analytic sample of 452 men who had engaged in group sex (with three or more other individuals) in the last 12 months.

Measures

Participants completed demographic measures (age, race/ethnicity, sexual orientation, etc.). Engagement in group sex was measured in the screener through the question “*Have you had group sex (sex with three or more people during a single sexual encounter) in the last 12 months?*”

GSE Activities

Participants were asked about the number of individuals in their last GSE with the question “*How many total participants were in your last group sex experience, including yourself?*” Twelve individuals reported their last GSE involved two other partners (i.e., a threesome) and were excluded from further analyses. An additional question assessed the gender identities of these partners. Other questions included number of insertive and receptive anal sex partners, number of insertive and receptive CAS partners, awareness of the HIV status of these partners, and number that were HIV-positive. Participants were also asked about substance use related to the encounter: “*Were you buzzed or drunk on alcohol during the last group sex encounter?*” and “*Did you use any drugs immediately before or during the last group sex encounter?*”

GSE Characteristics

Participants were also asked three questions about the GSE itself: (1) “*Where did the last group sex encounter take place?*” with the following response options: “My house or apartment,” “Someone else’s house or apartment,” “Hotel room,” “Dark room at a bar or club,” “Bathhouse,” “Sex club,” “Outdoors (e.g., public park),” and “Somewhere else.” (2) “*Was there a cover charge for this group sex event?*” with the following response options: “Yes, I paid money to get in;” “Yes, but I got in for free;” and “No.” (3) “*How far in advance did you know this event was going to happen?*” with the following response options: “I didn’t – it was spontaneous,” “Several hours,” “A day,” “Several days,” “A week,” and “several weeks.”

Analysis

All analyses were conducted in SAS v9.4 (Cary, NC). Three main outcome variables – GSE in last 12 months, and engagement in insertive or receptive CAS – were described using bivariable methods. Categorical predictors were assessed for associations with the outcomes using χ^2 test statistics, while associations with continuous predictors were assessed using Student’s *t*-tests. Unadjusted ORs were also calculated using logistic regression models for these outcomes. Multivariable logistic regression models were constructed for each dependent variable using manual stepwise elimination methods. All independent variables with $p < 0.10$ were included in the model and were excluded using backwards elimination until all predictors had $p < 0.10$. Previously excluded variables were retested and added back in if they resulted in at least a 10% increase in R^2 .

RESULTS

The majority of study participants self-identified as gay (83.6%), were White (63.7%), had at least a college degree (59.5%), and were employed full time (62.1%) (Table 1). Median

age was 33 years, with interquartile range (IQR): 26 – 44 years. Self-reported HIV prevalence in this sample was 15.6%, with 12.5% having never been tested for HIV.

More than one-third of study participants (36.0%) reported engaging in group sex (sex with three or more people during a single sexual encounter) in the past year. Participants who had at least a college education had significantly lower odds of engaging in group sex than those with some college education or those who graduated high school (Table 1). Compared with full time students, participants who were employed full time, part time, or unemployed had significantly greater odds of engaging in group sex. Individuals who identified as HIV-positive had significantly higher odds of attending a GSE in the past 12 months than those who were HIV-negative (OR = 1.99; 95% CI: 1.55, 2.55); conversely, those who had never tested for HIV had significantly lower odds of engaging in group sex than HIV-negative individuals (OR = 0.38; 95% CI: 0.27, 0.53). Compared with individuals with an annual income less than \$25,000, all participants had significantly greater odds of participating in a GSE, with a positive trend by income. In addition, men who engaged in group sex were significantly older than those who did not (37.7 years vs. 33.6 years; $p < 0.0001$). There were no significant associations with sexual orientation, race/ethnicity, or residence.

In multivariable logistic regression, attendance at a GSE in the past year was significantly associated with age, employment status, and HIV status (Table 1).

Last GSE

MSM reported that the number of participants in their last GSE ranged from 4 to 60 (mean = 5.95; standard deviation = 5.89). The majority of people in the last GSE were identified as male (97.2%); 3.0% were female and 0.2% were trans-female. Most participants said that their

last GSE took place in someone else's house/apartment (44.0%) or their own house or apartment (21.7%). Fewer encounters took place in a hotel room (15.8%), a bathhouse (11.9%), a sex club (3.9%), a dark room (1.7%), or outdoors (1.0%). Only 17.0% of MSM said that this last GSE required a cover charge, and 88.7% of these men said they actually paid that cover charge. More than half of GSEs occurred spontaneously (52.6%), and an additional 20.7% with only a few hours of notice.

More than one-third (34.4%) said they were buzzed or drunk on alcohol during their last GSE. Additionally, 6.0% said they used drugs before the encounter, 6.2% said they used drugs during the encounter, and 14.3% said they used drugs both before and during the encounter. The most frequently indicated drug was poppers (16.7%), followed by marijuana (11.6%), methamphetamine (10.2%), GHB (6.3%), crack/cocaine (2.8%), and prescription drugs that were not prescribed to the participant (0.9%).

At this last GSE, participants reported having insertive anal sex with a range of 0 – 18 men (mean = 1.58; standard deviation = 2.26) and receptive anal sex with a range of 0 – 23 men (mean = 1.52; standard deviation = 2.04). More than half of participants who reported insertive or receptive anal sex partners had condomless sex with at least one of those partners (insertive: 57.7%; receptive: 56.3%). Slightly fewer participants reported knowing the HIV status of any of their insertive anal sex partners (56.4%) than their receptive anal sex partners (62.4%). Similar proportions of MSM reported that at least one insertive or receptive anal sex partner of known status was HIV-positive (32.1% and 29.3%, respectively).

Drug use and condomless anal sex

Participants who reported using drugs before or during their last GSE had significantly greater odds of being HIV-positive (OR = 2.64; 95% CI: 1.62, 4.30) compared with HIV-negative individuals, and to have some college education compared with those who were at least college graduates (OR = 1.86; 95% CI: 1.16, 2.98). Additionally, those who used drugs had significantly lower odds of having an annual income of \$75,000 - \$99,999 (OR = 0.27; 95% CI: 0.10, 0.70) or more than \$100,000 (OR = 0.31; 95% CI: 0.14, 0.69) compared with those making less than \$25,000, and to be employed full time versus being a full time student (OR = 0.26; 95% CI: 0.10, 0.65). There were no associations with race/ethnicity or age.

Use of drugs was also significantly associated with engagement in CAS. MSM who indicated drug use had significantly higher odds of having insertive CAS (OR = 2.45; 95% CI: 1.37, 4.39) and receptive CAS (OR = 3.60; 95% CI: 1.96, 6.63) at their last group sex event. Insertive and receptive CAS both remained significantly associated with drug use after controlling for a number of covariates (Table 2). Conversely, having been drunk at last GSE was associated with a decreased likelihood of engaging in insertive CAS. Finally, HIV-positive MSM were more than three times as likely to have engaged in both insertive and receptive CAS at last group sex encounter compared with HIV-negative MSM.

DISCUSSION

Similar to findings from samples of MSM recruited through venue-based and online methods, approximately one-third of men recruited using a GSN mobile application reported attending at least one GSE in the prior year. Although more research is warranted to determine the true prevalence of GSE attendance among MSM in the US (2, 3, 6), it is clear that a substantial proportion of MSM are engaging in GSEs.

Consistent with previous research (2, 3), GSE participants were more likely to be HIV-positive, and these HIV-positive MSM were more likely to engage in condomless sex. Depending on the HIV status of their partners and their viral load, these condomless sex acts could pose a risk for HIV transmission during GSEs. Unfortunately, viral load was not assessed within this study, so decisions made based on a partner reporting an undetectable viral load cannot be parsed out. Therefore, future studies should investigate engagement in seroadaptive behaviors, such as selectively engaging in CAS with virally suppressed partners, as potential drivers for the greater rates of condomless sex among HIV-positive MSM. Additionally, research is needed into condom use patterns at GSEs: for MSM who only use condoms with some of their partners, how do they decide when not to use condoms?

There was also a clear association between drug use and engagement in CAS. This association has been well-documented, and has been found to be tied to HIV acquisition (12-14). Within the setting of a GSE, this association has frequently been explained through behavioral disinhibition and sexual adventurousness. For example, use of crystal meth has been found to increase sex-seeking and sexual risk-taking behaviors, which are in turn associated with HIV infection (5, 15). In a situation where one is having CAS with multiple partners, such as a GSE, this risk of HIV infection is greatly amplified. Interestingly, alcohol use was associated with decreased likelihood of engaging in insertive CAS. One possible explanation for this is the known association between alcohol intake and erectile dysfunction (16); drinking alcohol before/during a GSE could decrease one's ability to get and maintain an erection, which would lower their likelihood of engaging in insertive anal sex.

This study has several limitations. Participants consisted of a convenience sample of MSM recruited through a GSN mobile application. However, national research has shown that

nearly all American males (93%) own a cell phone (17), a study of MSM found that 72% owned a smartphone which would allow for access to such an application (18), and an additional study found that 63.6% of MSM recruited using venue-based sampling had used a GSN mobile application to look for sex partners in the prior year (19). Thus, these facts, plus the demonstrated demographic diversity of the sample increases the representativeness of this sample of MSM. All data were self-reported and could be biased. Recall bias was minimized by time anchoring all questions to either the last year or the last GSE. Social desirability bias was minimized through the use of an anonymous survey completed by individuals on their own phone. In addition, we were unable to parse the difference between threesomes and GSEs that included at least three other people in the initial screener question. Research has shown behavioral differences between threesomes and larger GSEs (6), and these differences could have biased our findings in our first series of analyses. Fortunately, we were able to remove individuals whose last GSE was a threesome from subsequent analyses. Finally, the survey routing procedure decreased the likelihood that men aged 18-29 years of age were directly administered this survey; however, the age distribution of respondents demonstrates that a substantial number of participants within this age range were included in this sample.

CONCLUSION

Engagement in GSEs is a common behavior among MSM throughout the United States. This study highlighted the prevalence of drug and alcohol use at these GSEs, and their association with condomless sex. These factors heighten the risk of HIV and STI acquisition, and demonstrate the importance of focusing more attention on sexual risk behaviors that occur outside of dyadic partnerships.

Table 1. Correlates and odds of men who have sex with men engaging in group sex (sex with 3 or more people in a single encounter) in the last 12 months, November 2014-February 2015 (n = 1,997).

	Total	Group sex	No group sex	X² (p-	Unadjusted		Adjusted	
	n (%)	n (%)	n (%)	value)	OR	95% CI	OR	95% CI
Race/ethnicity							--	--
Black/ African American	157 (8.3)	48 (30.6)	109 (69.4)	5.48	1.00	--		
Hispanic/Latino	362 (19.1)	131 (36.2)	231 (63.8)	(0.14)	1.29	0.86, 1.92		
White	1207 (63.7)	451 (37.4)	756 (62.6)		1.36	0.95, 1.94		
Other	169 (8.9)	51 (30.2)	118 (69.8)		0.98	0.61, 1.57		
Sexual orientation							--	--
Gay	1668 (83.6)	606 (36.3)	1062 (63.7)	0.18	1.00	--		
Bisexual	229 (11.5)	80 (34.9)	149 (65.1)	(0.91)	0.94	0.71, 1.26		
Other	98 (4.9)	36 (36.7)	62 (63.3)		1.02	0.67, 1.55		
Education							--	--
Elementary/Junior High	7 (0.4)	3 (42.9)	4 (57.1)	15.1	1.17	0.26, 5.26		
Some high school	30 (1.5)	8 (26.7)	22 (73.3)	(0.005)	0.57	0.25, 1.29		

	Total	Group sex	No group sex	X² (p-	Unadjusted		Adjusted	
	n (%)	n (%)	n (%)	value)	OR	95% CI	OR	95% CI
High school graduate	170 (8.5)	44 (25.9)	126 (74.1)		0.55	0.38, 0.78		
Some college	602 (30.2)	202 (33.6)	400 (66.5)		0.79	0.64, 0.97		
College graduate or more	1186 (59.5)	463 (39.0)	723 (61.0)		1.00	--		
Employment status								
Employed full time	1239 (62.1)	481 (38.8)	758 (61.2)	33.4	2.62	1.86, 3.70	1.65	1.14, 2.39
Employed part time	200 (10.0)	81 (40.5)	119 (59.5)	(<0.0001)	2.81	1.83, 4.33	1.93	1.23, 3.03
Full time student	231 (11.6)	45 (19.5)	186 (80.5)		1.00	--	1.00	--
Unemployed	193 (9.7)	67 (34.7)	126 (65.3)		2.20	1.42, 3.41	1.51	0.95, 2.39
Other	133 (6.7)	48 (36.1)	85 (63.9)		2.33	1.44, 3.78	1.15	0.68, 1.95
Annual income							--	--
Less than \$25,000	592 (32.4)	181 (30.6)	411 (69.4)	21.9	1.00	--		
\$25,000 - \$49,999	525 (28.7)	197 (37.5)	328 (62.5)	(0.0002)	1.36	1.06, 1.75		
\$50,000 - \$74,999	311 (17.0)	119 (38.3)	192 (61.7)		1.41	1.06, 1.88		
\$75,000 - \$99,999	173 (9.5)	73 (42.2)	100 (57.8)		1.66	1.17, 2.35		

	Total	Group sex	No group sex	X² (p-	Unadjusted		Adjusted	
	n (%)	n (%)	n (%)	value)	OR	95% CI	OR	95% CI
More than \$100,000	227 (12.4)	106 (46.7)	121 (53.3)		1.99	1.45, 2.72		
Area of residence							--	--
Rural	252 (13.2)	104 (41.3)	148 (58.7)	5.25	1.19	0.90, 1.57		
Suburban	657 (34.5)	220 (33.5)	437 (66.5)	(0.07)	0.85	0.69, 1.05		
Urban	995 (52.3)	370 (37.2)	625 (62.8)		1.00	--		
HIV status								
Negative	1417 (71.9)	508 (35.9)	909 (64.2)	73.7	1.00	--	1.00	--
Positive	308 (15.6)	162 (52.6)	146 (47.4)	(<0.0001)	1.99	1.55, 2.55	1.88	1.46, 2.42
Never tested	247 (12.5)	43 (17.4)	204 (82.6)		0.38	0.27, 0.53	0.48	0.34, 0.69
Age (years)					1.03	1.02, 1.04	1.02	1.01, 1.03

Table 2. Adjusted associations of men who have sex with men engaging in condomless anal sex at last group sex encounter (sex with at least 3 other people), November 2014-February 2015.

	Condomless receptive anal sex (n=267*)		Condomless insertive anal sex (n=231**)	
	aOR	95% CI	aOR	95% CI
HIV status				
Negative	1.00	--	1.00	--
Positive	3.54	1.67, 7.48	3.42	1.74, 6.74
Never tested	2.00	0.58, 6.83	2.13	0.51, 8.94
Education	--	--		
Elementary/Junior High			--	--
Some high school			1.76	0.14, 21.7
High school graduate			16.41	1.94, 138
Some college			2.03	1.02, 4.01
College graduate or more			1.00	--
Age (years)	1.05	1.02, 1.07	--	--
Used drugs before/during last group sex encounter	3.22	1.68, 6.15	2.83	1.45, 5.50
Drunk at last group sex encounter	--	--	0.44	0.23, 0.82

**Denominator consists of all MSM who reported engaging in receptive anal sex at their last GSE (n=272) and excludes 5 who did not answer drug use question.*

***Denominator consists of all MSM who reported engaging in insertive anal sex at their last GSE (n=239), and excludes 4 who did not answer drug use question and 4 who did not answer alcohol use question.*

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