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Pervasive Heavy Alcohol Use and Correlates of Increasing Levels of Binge Drinking among Men Who Have Sex with Men, San Francisco, 2011

Glenn-Milo Santos, Harry Jin, and H. Fisher Raymond

ABSTRACT *Heavy episodic drinking, "binge drinking", is highly prevalent among men who have sex with men (MSM) and is associated with sexual risk behaviors and HIV seroconversion in this population. We characterized the magnitude of binge drinking and explored correlates of increasing levels of binge drinking among MSM in San Francisco. In this study, 67 % of MSM reported binge drinking in the prior year. The mean number of drinking days in the past month was 11.6. On average, we estimate that 2,699,372 drinks are consumed by MSM in San Francisco every month. Increasing levels of binge drinking was independently associated with younger age, modest income, being born in the United States, never accessing alcohol treatment and reporting unprotected insertive anal intercourse. Our findings underscore the need to target effective strategies to address heavy alcohol consumption and highlight the urgent need to develop novel interventions beyond traditional alcohol treatment settings among MSM.*

KEYWORDS *Men who have sex with men, Alcohol, Binge drinking, HIV risk*

INTRODUCTION

Binge drinking—defined as having five or more drinks on a single occasion—and other heavy alcohol consumption patterns are associated with HIV risk behaviors and are major health issues for men who have sex with men (MSM) at high risk for acquiring or transmitting HIV. Alcohol use is deeply entwined with the social activities of MSM [1] and although drinking, per se, does not always predict unprotected intercourse, certain risk contexts are more consistently associated with alcohol use.[2,3] The acute effects of alcohol consumption (e.g., altered cognition, impaired judgment, and increased sexual desire and confidence) may contribute to risk-taking behaviors.[4–7] A myriad of psychosocial factors (e.g., cognitive escape, impulsivity, expectancies) are believed to mediate the association between alcohol and sexual risk behaviors.[5,8–13] Furthermore, bar and club venues frequented by MSM provide conducive environments for both meeting sexual partners and binge drinking.[1,14–16]

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Notably, *event-level* analyses of alcohol use immediately before or during sexual episodes in two separate systematic reviews consistently found that binge drinking is independently associated with increased likelihood of having unprotected sex.[3,17] These event-level assessments of alcohol use provide the most precise temporal link between these two behaviors and provide stronger evidence for causality.[2,17] Binge drinking and other patterns of heavy alcohol use are independently associated with a variety of high-risk behaviors in MSM, including unprotected anal sex, multiple partners, and having HIV-serodiscordant partners,[18–28] a link also observed among Black, Native American, and older MSM.[29–31]

Binge drinking and heavy alcohol consumption are major causes of incident HIV infections in MSM. Binge alcohol use was independently associated with a greater than threefold increase in odds for new HIV diagnoses among MSM who had a previously (past 12 months) negative HIV test in a case–control study.[32] In the EXPLORE study of HIV-negative MSM from six metropolitan areas, 29 % of HIV incidence was attributable to use of alcohol or other drugs before sex; 6.1 % was attributable to heavy alcohol use.[33] Similarly, in the Multicenter AIDS Cohort Study of HIV-negative MSM, the hazard for seroconversion among heavy drinkers was 61 % greater, compared to those who abstained from alcohol during the 24-year follow-up (1984–2008).[34]

Although binge drinking is a major driver of the HIV epidemic among MSM, little is known about the correlates of this pattern of alcohol consumption among this vulnerable group. Moreover, few analyses have explored correlates of increasing levels of binge drinking. We sought to address these gaps in the literature by characterizing the demographic, behavioral, and clinical correlates of binge drinking MSM in San Francisco. In addition, we conducted analyses to evaluate predictors of *increasing levels* of binge drinking.

METHODS

Data from MSM in this study were obtained during implementation of National HIV Behavioral Surveillance (NHBS) in San Francisco in 2011. NHBS is a CDC-led collaboration of 20 health jurisdictions in the USA which samples MSM, IDU, and high-risk heterosexuals on a 3-year cycle.[35] NHBS utilizes time location sampling to obtain relatively large quasi-probability samples of MSM.[36] In brief, a universe of venues and associated day-time periods where MSM are known to congregate is constructed through formative assessment. During data collection, a two-stage random selection of venues and then day-time periods is implemented. At the randomly selected venue day-time period, men are systematically approached, screened and if eligible invited to participate in an interviewer administered survey and HIV testing. Men received $50 USD for their participation. NHBS is conducted entirely anonymously. The San Francisco NHBS has IRB approval from the University of California, San Francisco.

The behavioral survey contains measures on demographics, sexual behavior, substance use, and self-reported sexually transmitted infections (STI). Alcohol use was assessed overall with the question “In the past 12 months did you drink any alcohol such as beer, wine, malt liquor or hard liquor?” Binge drinking was defined as having had five or more alcoholic drinks in one sitting. Number of days drinking in the past 30 days, the typical number of drinks in the past 30 days, and the number of times binge drinking occurred in the past 30 days were assessed. We grouped men

into no binge drinking, binge drinking 1–2 times in the past 30 days, and binge drinking 3 or more times in the past 30 days.

We compared alcohol use of MSM recruited at venues that do not serve alcohol to those recruited from venues that serve alcohol to illustrate any differences in alcohol consumption based on recruitment venue. Our bivariate analysis of the association with binge drinking was conducted using χ^2 tests. For model building, we used the algorithm suggested by Hosmer and Lemeshow in which predictors in the bivariate analyses with a p value <0.25 were included in the multivariable analysis and used a stepwise backward elimination approach to fit the most parsimonious model.[37,38] For multivariable analysis, we used ordered logistic regression to test associations with higher levels of binge drinking using the following levels: (1) no binge drinking in the past month, (2) binge drinking 1–2 times in the past month, and (3) binge drinking more than twice in the past month. All analyses were conducted in SAS 9.3 (Cary, NC).

RESULTS

Sample Characteristics

From July to December 2011, we recruited 510 MSM. Just over half of the men were white (58.8 %), 19.4 % were Latino, 9.6 % Asian and Pacific Islander, and 6.5 % Black. Almost equal proportions, the sample were 35 and younger and 36 and older. A majority held a bachelors degree or higher (56.9 %). About half of the men (49.0 %) were employed in full-time jobs. Over half of the men (53.8 %) earned $40,000 USD or higher annually and over a quarter (26.6 %) earned $75,000 USD or higher annually. A majority of men were born in the US (82.6 %). Finally, almost equal proportions of men were recruited at venues that did not serve alcohol (43.7 %) and at those that did serve alcohol (56.3 %) (Table 1).

Drinking Prevalence and Magnitude

The vast majority of MSM overall drank alcohol in the past 12 months (88.8 %); and over two thirds engaged in some level of binge drinking in the past 12 months. Among all MSM, the mean number of days drinking in the past 30 days was 11.6 days and the mean number of drinks on those days was 3.5. To get a sense of the magnitude of alcohol use among San Francisco MSM, we used a previously published population size estimate of 66,487 and the means for drinking days and mean number of drinks consumed to calculate the total number of drinks consumed.[39] On average, 2,699,372 drinks are consumed by MSM in San Francisco every 30 days (66,487 men×11.6 days×3.5 drinks).

We stratified the sample by whether the venue they were recruited at was one that served alcohol (Table 2). As expected, the proportion of men who used any alcohol, had any binge drinking, had higher episodes of binge drinking was significantly higher among men recruited at venues that served alcohol (p for all variables <0.001).

Correlates of Levels of Binge Drinking

In Table 3, we stratified the sample by whether (1) they engaged in no binge drinking in the past month, (2) binge drinking 1–2 times in the past month, and (3) binge drinking more than twice in the past month. Men who binge drank three or more times in the past month were more likely to be under age 36 (64.4 %) compared to

TABLE 1 Demographic characteristics NHBS MSM3, San Francisco, 2011

Variable	*n* (%)
Race/ethnicity	
Asian and Pacific Islander	49 (9.6)
Black	33 (6.5)
Native American	21 (4.1)
Native Hawaiian	6 (1.2)
White	300 (58.8)
Latino	99 (19.4)
Other/mixed	2 (0.4)
Age	
18–25	92 (18.0)
26–30	74 (14.5)
31–35	70 (13.7)
36–40	59 (11.6)
41–45	61 (12.0)
46–50	52 (10.2)
51+	102 (20.0)
Education	
High school or less	74 (14.5)
Some college	145 (28.4)
Bachelors	179 (35.1)
Any post grad	110 (21.6)
Employment status	
Employed full time	250 (49.0)
Employed part time	90 (17.7)
Student	33 (6.5)
Retired	22 (4.3)
Unemployed	74 (14.5)
Other	41 (8.0)
Annual income	
0–4999	33 (6.6)
5–9999	21 (4.2)
10–14,999	44 (8.8)
15–19,999	31 (6.2)
20–29,999	54 (10.8)
30–39,999	49 (9.8)
40–49,999	47 (9.4)
50–74,999	89 (17.8)
75,000+	133 (26.6)
Born in the USA	
No	89 (17.5)
Yes	421 (82.6)
Recruited site	
Venue that does not serve alcohol	223 (43.7)
Venue that serves alcohol	287 (56.3)

42.4 % and 36.7 % among binge drinking 1–2 times and no binge drinking, respectively (χ^2 65.4, $p<0.001$). There were no differences in terms of race/ethnicity, education, employment status, income, or being born in the USA.

TABLE 2 Alcohol use by recruitment venue type. NHBS MSM3, San Francisco, 2011

Variable	All MSM *n* (%)	Venues where alcohol is NOT served 223	Venues where alcohol is served 287	χ^2	*p* value
Any alcohol past 12				32.4	<0.0001
Yes	453 (88.8)	178 (80.5)	275 (96.2)		
No	57 (11.2)	45 (19.5)	12 (3.9)		
Frequency of binge, past 12 months				73.5	<0.0001
Never	172 (33.7)	114 (51.1)	48 (20.2)		
More than once a day	10 (2.0)	1 (0.5)	9 (3.1)		
Once a day	11 (2.2)	2 (0.9)	9 (3.1)		
More than once a week	89 (17.5)	15 (6.7)	74 (25.8)		
Once a week	52 (10.2)	16 (7.2)	36 (12.5)		
More than once a month	57 (11.2)	22 (9.9)	35 (12.2)		
Once a month	47 (9.2)	20 (9.0)	27 (9.4)		
Less than once a month	72 (14.1)	33 (14.8)	39 (13.6)		
Number of binge episodes, past month				64.4	<0.0001
0	265 (52.0)	153 (68.6)	112 (39.0)		
1–5	156 (30.6)	61 (27.4)	95 (33.1)		
6–10	42 (8.2)	6 (2.7)	36 (12.5)		
11–15	18 (3.5)	1 (0.5)	17 (5.9)		
16–20	10 (2.0)	0 (0.0)	10 (3.5)		
21–25	6 (1.2)	1 (0.5)	5 (1.7)		
26–30	13 (2.6)	1 (0.5)	12 (4.2)		
Mean (standard deviation) of number days drinking in the past 30 days	11.6, 9.1	9.7, 6.0	12.8, 10.0	−3.6	0.0004
Mean (standard deviation) of typical number of drinks	3.5, 2.8	2.7, 2.0	3.9, 3.1	−4.3	<0.0001

A higher proportion of men who did not binge drink were HIV-positive (27.6 %) compared to those that binge drank 1–2 or 3 or more times (10.6 and 15.0 %, respectively (χ^2 15.9, p=0.0003). There were no differences across the three groups in terms of self-reported STD or hepatitis history with the exception for a higher proportion of men who did not binge drinking reporting having had hepatitis B (15.5 %) compared to men who binge drank 1–2 times (7.1 %) or 3 or more times (4.4 %) (χ^2 14.3, p=0.0008). Finally, only having been in alcohol treatment in the past 12 months, 10.2 % among non-binge drinkers compared to 2.4 and 3.8 % among those who binge drank 1–2 times or 3 or more times, respectively, was significantly different across the three groups (χ^2 9.7, p=0.0078) (Table 3).

Bivariate Ordered Logistic Regression Analyses

The results of ordered logistic regression for variables individually suggest that there is steadily increasing odds of being a more frequent binge drinker associated with younger MSM. For example, MSM 18–25 have a 6.7-fold higher odds of binge drinking more frequently compared to those aged 51 or more years (p<0.01). Men who were retired (odds ratio [OR] 0.221, 95 % confidence interval [CI] 0.071, 0.627, p<0.01) or "other" employment status (OR 0.390, 95 % CI 0.194, 0.783, p<0.01) had lower odds of higher levels of binge drinking compared to men

TABLE 3 Binge drinking and HIV risk taking, NHBS MSM3, San Francisco, 2011

	No binge drinking in the past month	Binged once or twice the past month	Binged more than twice in the past month		
	n (%)	*n* (%)	*n* (%)	χ^2	*p* value
Race/ethnicity				9.4	0.6659
Asian and Pacific Islander	25 (9.4)	9 (10.6)	15 (9.4)		
Black	16 (6.0)	7 (8.2)	10 (6.3)		
Native American	10 (3.8)	4 (4.7)	7 (4.4)		
Native Hawaiian	3 (1.1)	0 (0.0)	3 (1.9)		
White	168 (63.4)	48 (56.5)	84 (52.5)		
Latino	42 (15.9)	17 (20.0)	40 (25.0)		
Other/mixed	1 (0.4)	0 (0.0)	1 (0.6)		
Age				65.4	<0.0001
18–25	36 (13.6)	14 (16.5)	42 (26.3)		
26–30	33 (12.5)	13 (15.3)	28 (17.5)		
31–35	28 (10.6)	9 (10.6)	33 (20.6)		
36–40	24 (9.1)	19 (22.4)	16 (10.0)		
41–45	31 (11.7)	9 (10.6)	21 (13.1)		
46–50	32 (12.1)	8 (9.4)	12 (7.5)		
51+	81 (30.6)	13 (15.3)	8 (5.0)		
Education				11.3	0.0792
High school or less	34 (12.9)	12 (14.1)	28 (17.5)		
Some college	72 (27.4)	26 (30.6)	47 (29.4)		
Bachelors	89 (33.8)	26 (30.6)	64 (40.0)		
Any post grad	68 (25.9)	21 (24.7)	21 (13.1)		
Employment status				19.2	0.0381
Employed full time	117 (44.2)	48 (56.5)	85 (53.1)		
Employed part time	45 (17.0)	15 (17.7)	30 (18.8)		
Student	16 (6.0)	8 (9.4)	9 (5.6)		
Retired	18 (6.8)	1 (1.2)	3 (1.9)		
Unemployed	40 (15.1)	9 (10.6)	25 (15.6)		
Other	29 (10.9)	4 (4.7)	8 (5.0)		
Annual income				27.3	0.0384
0–4999	14 (5.4)	7 (8.2)	12 (7.7)		
5–9999	9 (3.5)	1 (1.2)	11 (7.1)		
10–14,999	23 (8.9)	6 (7.1)	15 (9.6)		
15–19,999	19 (7.3)	2 (2.4)	10 (6.4)		
20–29,999	20 (7.7)	12 (14.1)	22 (14.1)		
30–39,999	35 (13.5)	8 (9.4)	6 (3.9)		
40–49,999	21 (8.1)	9 (10.6)	17 (10.9)		
50–74,999	45 (17.3)	14 (16.5)	30 (19.2)		
75,000+	74 (28.5)	26 (30.6)	33 (21.2)		
Born in the USA				5.0	0.0808
No	53 (20.0)	17 (20.0)	19 (11.9)		
Yes	212 (80.0)	68 (80.0)	141 (88.1)		
HIV status				15.9	0.0003
Negative	192 (72.5)	76 (89.4)	136 (85.0)		
Positive	73 (27.6)	9 (10.6)	24 (15.0)		

TABLE 3 Continued

	No binge drinking in the past month	Binged once or twice the past month	Binged more than twice in the past month		
	n (%)	*n* (%)	*n* (%)	χ^2	*p* value
Hepatitis A				7.3	0.0259
No	233 (87.9)	80 (94.1)	152 (95.0)		
Yes	32 (12.1)	5 (5.9)	8 (5.0)		
Hepatitis B				14.3	0.0008
No	224 (84.5)	79 (92.9)	153 (95.6)		
Yes	41 (15.5)	6 (7.1)	7 (4.4)		
Hepatitis C				3.3	0.1953
No	246 (92.8)	81 (95.3)	155 (96.9)		
Yes	19 (7.2)	4 (4.7)	5 (3.1)		
Genital herpes				0.8	0.6625
No	230 (86.8)	75 (88.2)	135 (84.4)		
Yes	35 (13.2)	10 (11.8)	25 (15.6)		
Genital warts				0.5	0.7767
No	214 (80.8)	67 (78.8)	132 (82.5)		
Yes	51 (19.3)	18 (21.2)	28 (17.5)		
HPV				0.6	0.7592
No	227 (85.7)	70 (82.4)	136 (85.0)		
Yes	38 (14.3)	15 (17.7)	24 (15.0)		
Gonorrhea				1.9	0.3826
No	245 (92.5)	75 (88.2)	143 (89.4)		
Yes	20 (7.6)	10 (11.8)	17 (10.6)		
Chlamydia				1.5	0.4733
No	250 (94.3)	79 (92.9)	146 (91.3)		
Yes	15 (5.7)	6 (7.1)	14 (8.8)		
Syphilis				6.9	0.0312
No	255 (96.2)	85 (100.0)	159 (99.4)		
Yes	10 (3.8)	0 (0.0)	1 (0.6)		
Unprotected receptive anal intercourse				5.3	0.0692
No	196 (74.0)	53 (62.4)	106 (66.3)		
Yes	69 (26.0)	32 (37.7)	54 (33.8)		
Unprotected insertive anal intercourse				3.6	0.1667
No	178 (67.2)	53 (62.4)	93 (58.1)		
Yes	87 (32.8)	32 (37.7)	67 (41.9)		
Number times unprotected receptive anal intercourse				7.1	0.1292
0	196 (74.0)	53 (62.4)	106 (66.3)		
1–5	33 (12.5)	18 (21.2)	23 (14.4)		
6+	36 (13.6)	14 (16.5)	31 (19.4)		
Number times unprotected insertive anal intercourse				4.3	0.3637
0	178 (67.2)	53 (62.4)	93 (58.1)		
1–5	42 (15.9)	18 (21.2)	32 (20.0)		
6+	45 (17.0)	14 (16.5)	35 (21.9)		

TABLE 3 Continued

	No binge drinking in the past month	Binged once or twice the past month	Binged more than twice in the past month		
	n (%)	*n* (%)	*n* (%)	χ^2	*p* value
Any potentially serodiscordant partnerships[a]					
HIV participant					
No	127 (67.2)	58 (78.4)	89 (65.4)	4.1	0.1293
Yes	62 (32.8)	16 (21.6)	47 (34.6)		
HIV+ participant					
No	43 (58.9)	3 (33.3)	14 (58.3)	2.2	0.3378
Yes	30 (41.1)	6 (66.7)	10 (41.7)		
Ever been in alcohol treatment				6.5	0.0397
No	211 (79.6)	77 (90.6)	137 (85.6)		
Yes	54 (20.4)	8 (9.4)	23 (14.4)		
In alcohol treatment last 12 m				9.7	0.0078
No	238 (89.8)	83 (97.7)	154 (96.3)		
Yes	27 (10.2)	2 (2.4)	6 (3.8)		
Tried to get into alcohol treatment but couldn't get in				2.3	0.3182
No	259 (97.7)	85 (100.0)	158 (98.8)		
Yes	6 (2.3)	0 (0.0)	2 (1.3)		

[a]Five people with invalid results/unknown results not included

employed full time. Men with an annual income of $20,000–29,999 had higher odds of having a higher level of binge drinking (OR 2.046, 95 % CI 1.124, 3.725, $p<0.05$) than men who earned $75,000 or more per year. HIV-positive MSM had lower odds (OR0.448, 95 % CI 0.289, 0696, $p<0.01$) of having a higher level of binge drinking compared to HIV-negative MSM. Similar results were found for self-reported STDs. Odds of having higher levels of binge drinking were lower for those reporting hepatitis A (OR 0.416, 95 % CI 0.215, 0.801, $p<0.01$), hepatitis B (OR 0.304, 95 % CI 0.160, 0.579, $p<0.01$), and syphilis (OR0.110, 95 % CI 0.015, 0.829, $p<0.05$) compared to those who did not report having the disease. Finally, alcohol treatment ever and in the past 12 months had lower odds of being at a higher level of binge drinking.

Multivariable Ordered Logistic Regression Analyses

In the multivariable ordered logistic regression model, age, income, being born in the USA, having unprotected insertive anal intercourse and never accessing alcohol treatment were significantly associated with greater odds of more frequent binge drinking in the past month (Table 4). All age groups had higher odds of being at higher levels of binge drinking compared to men aged 51 years or more. Men with incomes of $20,000 to 29,999 (OR 2.942, 95 % CI 1.390, 6.225, $p<0.01$) per year had higher odds of having higher levels of binge drinking compared to men earning

TABLE 4 Ordered logistic regression analyses with level of binge drinking, NHBS MSM3, San Francisco, 2011

	OR (95 % CI)	AOR (95 % CI)
Age		
18–25	6.757 (3.640, 12.544)**	4.766 (2.332, 9.785)**
26–30	5.097 (2.673, 9.720)**	4.761 (2.242, 10.111)**
31–35	6.870 (3.569, 13.224)**	9.186 (4.185, 20.161)**
36–40	4.559 (2.306, 9.011)**	4.434 (1.954, 10.065)**
41–45	4.121 (2.093, 8.114)**	3.420 (1.471, 7.953)**
46–50	2.522 (1.221, 5.212)*	2.399 (0.993, 5.793)
51+	ref	ref
Education		
High school or less	1.136 (0.683, 1.891)	
Some college	0.942 (0.622, 1.426)	
Bachelors	ref	
Any post grad	0.547 (0.342, 0.874)*	
Employment status		
Employed full time	ref	
Employed part time	0.916 (0.581, 1.446)	
Student	0.855 (0.429, 1.706)	
Retired	0.221 (0.071, 0.627)**	
Unemployed	0.834 (0.509, 1.367)	
Other	0.390 (0.194, 0.783)**	
Annual income		
0–4999	1.680 (0.818, 3.451)	1.997 (0.829, 4.810)
5–9999	2.372 (0.994, 5.660)	2.394 (0.776, 7.382)
10–14,999	1.281 (0.668, 2.455)	2.281 (0.969, 5.367)
15–19,999	0.963 (0.449, 2.064)	1.280 (0.521, 3.148)
20–29,999	2.046 (1.124, 3.725)*	2.942 (1.390, 6.225)**
30–39,999	0.499 (0.247, 1.006)	0.548 (0.238, 1.263)
40–49,999	1.594 (0.849, 2.994)	1.420 (0.689, 2.929)
50–74,999	1.327 (0.794, 2.219)	1.467 (0.804, 2.676)
75,000+	ref	ref
Born in the USA		
No	0.641 (0.408, 1.008)	0.374 (0.219, 0.639)**
Yes	ref	ref
HIV status		
Negative	ref	
Positive	0.448 (0.289, 0.696)**	
Hepatitis A		
No	ref	
Yes	0.416 (0.215, 0.801)**	
Hepatitis B		
No	ref	
Yes	0.304 (0.160, 0.579)**	
Hepatitis C		
No	ref	
Yes	0.486 (0.218, 1.081)	
Syphilis		
No	ref	
Yes	0.110 (0.015, 0.829)*	
Unprotected receptive anal intercourse		
No	ref	

TABLE 4 Continued

	OR (95 % CI)	AOR (95 % CI)
Yes	1.414 (0.988, 2.022)	
Unprotected insertive anal intercourse		
No	ref	ref
Yes	1.392 (0.988, 1.961)	1.737 (1.141, 2.645)*
Number times unprotected receptive anal intercourse		
0	ref	
1–5	1.319 (0.821, 2.120)	
6+	1.512 (0.959, 2.385)	
Any potentially serodiscordant partnerships[a]		
HIV participant		
No	ref	
Yes	1.020 (0.685, 1.519)	
Ever been in alcohol treatment		
No	ref	ref
Yes	0.624 (0.393, 0.991)*	0.410 (0.225, 0.748)**
In alcohol treatment last 12 m		
No	ref	
Yes	0.318 (0.144, 0.700)**	

Levels of binge drinking in the past month: *1* none, *2* 1–2 times, *3* 3 or more times

*$p<0.05$; **$p<0.01$

[a]Five people with invalid results/unknown results not included

$75,000 or more per year. Those who reported unprotected insertive anal intercourse had greater (OR 1.737, 95 % CI 1.141, 2.645, $p<0.01$) odds of more frequent binge drinking, compared to those who did not have unprotected insertive anal intercourse. Those who were born outside the USA had significantly lower odds of having higher levels of binge drinking (OR 0.374, 95 % CI 0.219, 0.639, $p<0.01$). Finally, having been in alcohol treatment in the past 12 months had lower odds of having higher levels of binge drinking (OR 0.410, 95 % CI 0.225, 0.748, $p<0.05$).

DISCUSSION

Our analysis of a sample of MSM in San Francisco suggests, as expected, that alcohol use is high among MSM overall but highest, also as expected, among MSM who were recruited at alcohol-serving venues. Moreover, binge drinking is pervasive in this population with almost half of all men reporting at least 1 episode of binge drinking in the past month. The prevalence of binge drinking among MSM in our study is much higher compared to adult men in the general US population (48 versus 23.2 %, respectively).[40] In addition, we found that those who reported higher levels of binge drinking were less likely to report ever utilizing alcohol treatment programs.

The high prevalence of binge drinking and the low levels of lifetime treatment utilization, especially among frequent binge drinkers, highlight the urgent need to develop novel alcohol reduction interventions for binge drinking MSM beyond traditional treatment settings. Given the ubiquity of drinking among MSM, and the prominent role drinking venues play in the interactions of MSM,[41,42] multilevel strategies and structural interventions addressing contextual issues related to alcohol consumption would be of great importance for this population. Of note, efforts to

enlist drinking establishments as partners in the reduction of alcohol consumption may face barriers as alcohol consumption among MSM is evidently a lucrative business.[43,44] Specifically, we note that the magnitude of alcohol consumption among MSM is in the millions of drinks per month. Nevertheless, the development of venue and field-based strategies to address the overlap between drinking and HIV risk are active area of research; more efforts are needed to mitigate these risk environments.[45,46] In addition, the use of pharmacologic interventions in combination with substance use and HIV risk reduction counseling may help support MSM who wish to reduce or stop their alcohol consumption. For example, the use of oral naltrexone on an as-needed, intermittent basis is currently being evaluated to address binge drinking and alcohol-associated sexual risk behaviors among MSM, in concert with risk reduction counseling.[47,48] Such combination prevention strategies have already been found to be efficacious in addressing the overlap between substance and HIV risk in this population;[49,50] thus, developing analogous combination strategies for alcohol should be prioritized for MSM at risk for HIV.

We also found that increasing levels of binge drinking was independently associated with increasing odds of having unprotected insertive anal intercourse. Moreover, we found that increasing levels of binge drinking was significantly more prevalent among younger MSM than any other age groups. This finding is consistent with national data which have noted the highest prevalence of binge drinking among persons between the ages of 18–24. The association between engaging in sexual risk behaviors and younger age among MSM and increasing levels of binge drinking is of particular significance given in the increasing HIV incidence among YMSM and the purported linkages between binge drinking and HIV-related risk. Taken together, these data highlight the need to not only develop interventions to screen and refer YMSM and MSM who engage in sexual risk behaviors for problematic alcohol use but also develop effective interventions that can reduce alcohol-associated harms in this vulnerable population.

Our data also show that moderate to low income was significantly associated with higher odds of having higher levels of binge drinking. In contrast, national estimates for the general adult population observed that binge drinking is most prevalent among those with higher income (>$75,000).[40] This suggests that the needs of binge drinking MSM may differ from other binge drinking MSM, particularly if they tend to be more economically disadvantaged than their general adult counterparts. This population may likely benefit from prioritized alcohol services that are free or low cost.

As with all studies, there are limitations to our analysis. First, although men may have been recruited at venues that did not serve alcohol, we did not measure whether these men frequented alcohol serving venues and at what frequency of attendance. Secondly, social desirability bias could have come into play as this was an interviewer-administered survey. Men may have reported less drinking and sexual risk behaviors due to this bias. Utilizing alcohol biomarkers that can function as objective measures of drinking would greatly enhance estimates of alcohol consumption but also enhance the accuracy of self-reported measures.[51] Recall bias may have also affected the data because participants were asked to recount prior drinking patterns and sexual activities from the past 6 months. In addition, the questionnaire used in this study had different recall periods between sexual risk behavior measures and recent binge drinking (6 months versus 1 month). Hence, the narrower recall window for binge drinking may have limited our ability to detect significant associations. Lastly, our sampling approach by design only samples MSM

who attend venues known to be frequented by MSM. MSM who never attend such venues are excluded.

Despite these limitations, our study gives a current assessment of the substantial prevalence of binge drinking among MSM in an urban setting. The pervasiveness of binge drinking and heavy alcohol use among MSM will likely to lead to a myriad of other health problems in this population; and efforts to mitigate these hazardous levels of consumption are urgently needed.[40] Ongoing research into health consequences for MSM (both HIV-negative and HIV-positive) on high levels of alcohol consumption is warranted, and it is imperative to develop effective alcohol interventions and harm reduction strategies for this population.

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