Published in final edited form as:

AIDS Behav. 2017 July ; 21(7): 1904–1913. doi:10.1007/s10461-017-1734-5.

Event-level associations among drinking motives, alcohol consumption, and condomless anal sex in a sample of young men who have sex with men

Brian A. Feinstein^{1,2,a} and Michael E. Newcomb^{1,2}

¹Department of Medical Social Sciences, Northwestern University, Feinberg School of Medicine, Chicago, IL

²Northwestern University Institute for Sexual and Gender Minority Health and Wellbeing, Chicago, IL

Abstract

Young men who have sex with men (YMSM) are at increased risk for HIV and problematic alcohol use. Drinking motives are associated with alcohol use in cross-sectional studies, but their associations with alcohol use and condomless anal sex (CAS) at the event-level remain unclear. The current study examined these event-level associations in a sample of 189 YMSM who completed self-report measures on a daily or weekly basis for two months. Participants were recruited between August 2014 and April 2015 for a randomized trial designed to study behavioral reactivity in diary studies. YMSM consumed more alcohol on days when they drank to cope, to enhance pleasure, or to be more social. CAS with casual partners was more likely on days when they consumed more alcohol. Drinking motives were not associated with CAS. Interventions may benefit from addressing drinking motives and the influence of alcohol use on CAS in different types of relationships.

Keywords

drinking motives; alcohol; sexual risk behavior; men who have sex with men; condomless anal sex

INTRODUCTION

HIV and problematic alcohol use, including alcohol use disorders, are two epidemics that disproportionately affect young men who have sex with men (YMSM). In 2015, MSM

^aCorresponding author: Brian Feinstein, Department of Medical Social Sciences, Feinberg School of Medicine, Institute for Sexual and Gender Minority Health and Wellbeing, Northwestern University, 625 N Michigan Ave Suite 2700, Chicago, IL 60611, (p) 312.503.6516, (f) 312.503.4800, brian.feinstein@northwestern.edu.

Compliance with Ethical Standards:

Conflict of Interest: Brian A. Feinstein declares that he has no conflict of interest. Michael E. Newcomb declares that he has no conflict of interest.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

Informed consent: Informed consent was obtained from all individual participants included in the study.

accounted for 67% of all new HIV infections and 82% of new HIV infections among men (1). Further, YMSM ages 13–24 and 25–34 had the highest rates with increases of 6% and 18%, respectively, from 2010–2014 (1). YMSM also report higher rates of alcohol use compared to their heterosexual peers, a finding that is consistent across multiple studies (2–6). Given the rising HIV incidence and increased rates of alcohol use among YMSM, there is an urgent need to understand risk factors for these health outcomes in this population.

The motivational model of alcohol use (7) may help to explain what puts YMSM at risk for problematic alcohol use and it may also help to clarify inconsistent findings regarding the link between alcohol use and sexual risk behavior. The model posits that people drink to attain specific outcomes (e.g., to decrease negative emotions, to increase positive emotions, to facilitate social interactions) (8, 9), and greater endorsement of these motives is associated with increased alcohol use and problems (for a review, see 10). Despite substantial evidence that drinking motives act as risk factors for problematic alcohol use, they have received limited attention among YMSM, especially in regard to sexual risk behavior.

A few studies have replicated the associations between drinking motives and alcohol use/problems in samples of sexual minorities, including YMSM (11–14). A recent study also demonstrated that some MSM are motivated to drink to enhance sex, which is also associated with greater alcohol use and problems (11). A major gap in the literature on drinking motives among YMSM is that all of the aforementioned studies operationalized drinking motives as stable traits rather than states that fluctuate across drinking episodes. However, the motivational model of alcohol use posits that motivation for drinking is situationally activated rather than a reflection of individual differences. In fact, event-level studies using presumably heterosexual samples have found that 26–60% of the variance in drinking motives is accounted for by within-person fluctuation across drinking episodes (15, 16). As such, event-level studies are required to improve our understanding of episode-specific risk factors for problematic drinking among YMSM. If we can determine which motivations are more strongly associated with heavier drinking on specific occasions, then interventions to reduce problematic drinking may be enhanced by targeting those motivations.

While there is accumulating research on drinking motives and alcohol use, to our knowledge only one study has examined the influence of drinking motives on sexual risk behavior among MSM. Kahler, Wray (11) found that sexual motives for drinking were associated with engaging in sex under the influence of alcohol or other substances, but not condomless anal sex (CAS). They suggested that other factors may be more relevant to predicting CAS, such as the amount of alcohol consumed and attitudes toward condom use. However, research has yet to examine the associations between other drinking motives (e.g., to cope with negative emotions, to enhance pleasure, to facilitate social interactions) and CAS, especially at the event-level. Additionally, although research has consistently demonstrated that illicit drug use is associated with sexual risk behavior (17–20), findings have been inconsistent for alcohol use (17, 18) and event-level studies typically do not find a significant association between alcohol use and sexual risk behavior (21–24). Drinking motives may help to explain these inconsistent findings, as the influence of alcohol use on sexual risk behavior may depend on one's motivation for drinking. For instance, if someone is drinking to cope with negative emotions, then heavier drinking may contribute to

engaging in CAS, because that person may be more prone to the disinhibiting effects of alcohol.

Finally, several event-level studies that did not find a significant association between alcohol use and sexual risk behavior did not take into account potential differences between casual and serious relationships (21, 23, 25). There is some evidence that alcohol has a different effect on sexual behavior with casual versus serious partners, although findings have been mixed. In a sample of young adults (33% MSM), alcohol use had a stronger influence on sex among single people compared to partnered people (24). Additionally, an event-level study found a positive association between alcohol use before sex and CAS with casual partners, but not serious partners (26). These findings suggest that alcohol use has less of an influence on sexual behavior with serious partners. However, another study examined partner-by-partner associations between alcohol use before sex and CAS and found that the association strengthened over the course of development for serious partners, but not casual partners (27). These inconsistencies appear to be due, in part, to methodological differences (e.g., event-level versus partner-by partner analyses). Although additional research is needed to understand how relationship type influences the association between alcohol use and CAS, the existing evidence suggests that the association should be examined separately for casual versus serious partners. As such, we examined the associations between alcohol-related variables (alcohol consumption and drinking motives) and CAS with casual versus serious partners.

In sum, the goals of the current study were: (1) to examine the event-level associations between drinking motives and alcohol consumption in general and before sex; and (2) to examine the event-level associations between drinking alcohol-related variables (alcohol consumption and drinking motives) and CAS with casual versus serious partners. A sample of 189 YMSM completed daily or weekly self-report measures of alcohol use, sexual risk behavior, and four drinking motives (drinking to cope with negative emotions, to enhance pleasure, to be more social, and to enhance sex). We hypothesized that all of the drinking motives would be positively associated with alcohol consumption in general and before sex at the event-level. We did not make different hypotheses for each of the drinking motives, because a daily diary study found that their associations with desire to drink were similar in strength (15). Additionally, we hypothesized that all of the drinking motives and alcohol consumption would be positively associated with CAS at the event-level, with associations being stronger for CAS with casual partners (as opposed to serious partners).

METHODS

Participants and Procedures—The current study utilized baseline and prospective diary data from a subset of 189 YMSM who participated in a larger project (28), which was a two-month diary study of substance use and sexual behavior designed to study behavioral reactivity. The initial sample included 370 YMSM who met the following inclusion criteria: (1) assigned male at birth and reported current male gender identity; (2) between ages 16 and 29 at baseline; (3) reported oral or anal sex with a man during the past 6 months; (4) reported any binge drinking (i.e., 5 or more drinks on a single occasion) (29) or illicit drug use during the past 30 days; and (5) reported HIV-negative or unknown serostatus. Although

the initial sample included 370 YMSM, 181 were excluded from the current analyses because: (1) they were in the no diary control condition and, as such, did not have event-level data ($N = 129$); or (2) despite endorsing binge drinking or illicit drug use in the 30 days prior to completing the eligibility screener, they did not report drinking alcohol or having sex on any days during the two-month diary period and, as such, did not have event-level data ($N = 52$). The final analytic sample included 189 YMSM.

Participants were recruited through national Facebook advertisements between August 2014 and April 2015. Advertisements targeted men who were interested in men and described a study focused on men's health. Those who clicked on the advertisements were linked to a landing page that described the study and directed interested individuals to a screener. The screener assessed the above inclusion criteria as well as demographic and contact information to facilitate identification of duplicate or fake participants. Eligible participants were sent a link to complete a baseline assessment. Those who completed the baseline assessment were randomized to one of three diary conditions: daily diaries ($N = 120$), weekly diaries ($N = 121$), and a no diary control condition ($N = 129$).

Participants in the daily diary condition were asked to report their substance use and sexual behavior from the preceding day, while those in the weekly diary condition were asked to report these behaviors retrospectively for each day of the preceding week. Participants who were assigned to the daily diary condition received an email link each day for 56 consecutive days to complete their diary surveys, while participants in the weekly diary condition received an email link each week for eight consecutive weeks to complete their diary surveys (seven daily reports within each weekly survey). Participants in each of the diary conditions were allotted 48 hours to complete each diary survey and automated emails were sent to remind them to complete their diary surveys. Within each of these two diary conditions, half of the participants were randomly assigned to receive automated feedback each week. Feedback was delivered in the form of graphic illustrations of their frequencies of substance use and sexual behavior, as well as change in these risk behaviors from the prior weeks. Participants were compensated up to \$60 for their involvement, pro-rated based on their level of completion. All procedures were approved by the Institutional Review Board at Northwestern University. Parental permission was waived under 45 CFR 46.408(c) for minors (ages 16–17) (30). Informed consent was completed online prior to beginning the baseline assessment and participants were advised to complete surveys on personal devices in private spaces.

Baseline Measures

Demographics—Demographic characteristics were assessed, including age, sexual orientation, race/ethnicity, highest level of education completed, self-reported HIV status, current student status, current employment status, and geographic region (based on zip codes). See Table I for response options and descriptive results.

Alcohol use problems—The Alcohol Use Disorders Identification Test (AUDIT) (31) is a 10-item measure of alcohol use and problems in the past six months. Items are rated on different Likert-type scales depending on the question. For instance, response options for

“How often do you have a drink containing alcohol?” include: never (1), monthly or less (2), 2 to 4 times a month (3), 2 to 3 times a week (4), and 4 or more times a week (5). Response options for “How often do you have six or more drinks on one occasion?” include: never (0), less than monthly (1), monthly (2), weekly (3), and daily or almost daily (4). Total scores are computed by summing responses. Risk levels include: low-risk drinking or abstinence (0–7), alcohol use in excess of low-risk guidelines (8–15), harmful and hazardous drinking (16–19), and possible alcohol dependence (20) (32). Cronbach’s alpha was .79.

Marijuana use problems—The Cannabis Use Disorders Identification Test – Revised (CUDIT-R) (33) is an eight-item measure of marijuana misuse and problems in the past six months. Similar to the AUDIT, items are rated on different Likert-type scales depending on the question. For instance, response options for “How often do you use marijuana?” include: never (1), monthly or less (2), 2 to 4 times a month (3), 2 to 3 times a week (4), and 4 or more times a week (5). Response options for “Have you ever thought about cutting down, or stopping, your use of marijuana?” include: never (1), yes, but not in the past 6 months (2), and yes, during the past 6 months (3). Total scores are computed by summing responses and scores of 13 or higher suggest problematic use (33). Cronbach’s alpha was .77.

Lifetime illicit drug use—Participants were asked, “Have you ever used other drugs besides marijuana?” Those who had used illicit drugs were asked if they had ever used the following specific illicit drugs: cocaine, methamphetamine, ecstasy, ketamine, GHB, psychedelics, inhalants, opiates, heroin, poppers, and erectile dysfunction medications.

Event-level Measures

Drinking motives—Four drinking motives were assessed on a daily basis – drinking to cope, to enhance pleasure, to be more social, and to enhance sex. The measure was based on the Drinking Motives Questionnaire – Revised – Short Form (DMQ-R-SF) (34). Each day for two months, participants were asked to indicate if they drank alcohol that day. On days when they drank alcohol, they were presented with the following directions: “Here is a list of reasons people give for drinking alcohol. What were the reasons you drank alcohol on [date]?” The list included 11 reasons. Four reasons assessed drinking to cope (to forget my worries, because I was feeling depressed or nervous, to feel more self-confident, to forget about my problems), four reasons assessed drinking to enhance pleasure (because I like the feeling, because it’s exciting, to get drunk or high, because it’s fun), two reasons assessed drinking to enhance sex (to help me relax about having sex, to feel horny or turned on), and one reason assessed drinking to be more social (to help me talk to people or feel more social). Participants were instructed to choose all that applied (yes or no). Composite variables were created for each drinking motive. If a participant endorsed any drinking motive in a category, then they received a 1 for that category. If they did not endorse any drinking motives in a category, then they received a 0 for that category. Given that participants only completed the drinking motives measure on days when they endorsed drinking, there were too few participants who completed it on most days to test its psychometric properties (35). However, it is based on the DMQ-R-SF and previous research has confirmed the four-factor structure of the measure and acceptable internal consistency of the four subscales (α ranges from .70 to .83) (34).

Alcohol consumption—Participants were asked to indicate whether or not they drank alcohol for every day during a two-month period. On days when they drank alcohol, they were asked to report how many drinks they consumed. To reduce outliers, number of drinks consumed was Winsorized at three standard deviations. Winsorization reduces the impact of outliers by converting them to the value of the highest data point not considered to be an outlier (36). As such, values greater than three standard deviations (i.e., values greater than 17) were set to equal 17 (0.01% of the data). Across 1,768 drinking occasions, the mean and standard deviation of the Winsorized data were 4.38 and 3.43, respectively.

Alcohol consumption before sex—Participants were asked to indicate whether or not they had sex for every day during a two-month period. On days when they had sex, they were asked if they drank alcohol before sex. If they drank alcohol before sex, then they were asked to report how many drinks they consumed. To reduce outliers, number of drinks consumed before sex was Winsorized at three standard deviations. As such, values greater than 14 were set to equal 14 (0.02% of the data). Across 289 drinking before sex occasions, the mean and standard deviation of the Winsorized data were 4.42 and 2.84, respectively.

Condomless anal sex (CAS)—Participants were asked to indicate whether or not they had anal sex for every day during a two-month period. On days when they had anal sex, they were asked if they were the receptive partner (“bottom”), the insertive partner (“top”), or both. For each type of anal sex they endorsed, they were asked if they used a condom. They were also asked to indicate their relationship with each partner. Response options included: (1) serious relationship; (2) casually dating but not serious; (3) sleeping with this person but not dating (fuck buddy or booty call); (4) one night stand; and (5) stranger or anonymous person. We computed separate variables for CAS with serious partners (response option 1) and CAS with casual partners (response options 2–5). Analyses focused on CAS with serious partners only included participants who endorsed anal sex with serious partners and analyses focused on CAS with casual partners only included participants who endorsed anal sex with casual partners.

Analyses

Analyses were conducted in HLM 6.08. Poisson distributions were modeled when the outcome was a count variable (number of drinks consumed in general and before sex) and Bernoulli distributions were modeled when the outcome was a dichotomous variable (CAS with casual and serious partners). Overdispersion was corrected for when the standard deviation was larger than the mean for the outcome (CAS with casual partners). All results reported are from the unit-specific models with robust standard errors and 95% confidence intervals (CIs) that do not include 1 are significant a $p < .05$.

Prior to testing our hypotheses, we conducted several preliminary analyses. First, we examined the intraclass correlation coefficient (ICC) for each count variable and the weighted kappa for each dichotomous variable by testing unconditional models (models without predictors). The ICC represents the ratio of the between-person variance to the total variance. A higher ICC indicates that a larger proportion of the total variance is accounted for by differences between participants (versus within-person fluctuation across

observations). Interpretation of the weighted kappa is analogous to the ICC. The weighted kappa represents the extent to which agreement between observations in the same cluster (i.e., within-person) exceeds agreement between observations from different clusters (i.e., between-person). A higher weighted kappa indicates a greater degree of within-person consistency across repeated observations. Then, we examined whether study conditions influenced each outcome by entering diary type (0 = weekly, 1 = daily) and feedback (0 = no, 1 = yes) as level-2 predictors of each outcome in separate analyses. If either had a significant effect, then it was included as a covariate in subsequent analyses focused on that outcome.

To test our hypotheses, we examined the event-level associations between: (1) drinking motives and alcohol consumption (in general and before sex); and (2) alcohol-related variables (alcohol consumption and drinking motives) and CAS with casual versus serious partners. First, we estimated the bivariate associations between each level-1 predictor and each outcome. Then, we included all four drinking motives as level-1 predictors of each outcome to estimate their relative associations.

RESULTS

The mean age of the analytic sample was 22.96 ($SD = 3.08$). Most participants identified as gay (85.7 %) followed by bisexual (13.2 %) and other (1.1 %). The sample was racially/ethnically diverse with the largest percentages of participants identifying as White (45.0 %), Hispanic/Latino (25.9 %), Black/African American (20.1 %), and multi-racial (6.3 %). Additional demographic characteristics (highest level of education, HIV status, student status, employment status, and geographic region) are reported in Table I. In regard to alcohol use problems, the mean score on the AUDIT was 8.48 ($SD = 5.70$) and 52% of the sample scored in the low-risk drinking or abstinence range, 34% in the alcohol use in excess of low-risk guidelines range, 9% in the harmful and hazardous drinking range, and 5% in the possible alcohol dependence range. In regard to marijuana use problems, the mean score on the CUDIT-R was 5.31 ($SD = 6.33$) and 15% of the sample scored in the problematic marijuana use range (note that baseline descriptive data for the AUDIT and CUDIT-R differ from a previous article due to differences in the analytic samples (37). Additionally, 39% of the sample endorsed any lifetime illicit drug use, including cocaine (21%), ecstasy (19%), psychedelics (12%), poppers (11%), opiates (10%), methamphetamine (9%), inhalants (8%), ketamine (4%), GHB (3%), heroin (1%), and erectile dysfunction medications (1%).

The ICCs were .37 and .32 for alcohol consumption in general and before sex, respectively. This indicates that 37% and 32% of the variance in number of drinks consumed (in general and before sex, respectively) were due to between-person differences, whereas 63% and 68% of the variance (in number of drinks consumed in general and before sex, respectively) were due to within-person fluctuation across drinking episodes. The weighted kappas were .31 for drinking to cope, .50 for drinking to enhance pleasure, .33 for drinking to be more social, and .25 for drinking to enhance sex. The weighted kappas were .35 for CAS with casual partners and .72 for CAS with serious partners. Participants were largely inconsistent in their endorsement of drinking motives and CAS with casual partners across days, whereas they were largely consistent in their endorsement of CAS with serious partners across days.

Diary condition was not significantly associated with any of the outcome variables. Feedback condition was only significantly associated with CAS with serious partners (OR = 4.41, 95% CI = 1.24, 15.72), so it was included as a covariate in all analyses focused on that outcome variable.

First, we examined the event-level associations between drinking motives and alcohol consumption (see Table II). Largely consistent with hypotheses, there were significant positive associations between three of the drinking motives (drinking to cope, to enhance pleasure, and to be more social) and number of drinks consumed. In contrast, drinking to enhance sex was not significantly associated with number of drinks consumed. Although there was a significant positive association between drinking to cope and number of drinks consumed before sex in the bivariate analysis, it became non-significant in the multivariate analysis. None of the other drinking motives were significantly associated with number of drinks consumed before sex.

Then, we examined the event-level associations between the alcohol-related variables (drinking motives and alcohol consumption) and CAS (see Table III). There were significant positive associations between alcohol consumption (in general and before sex) and CAS with casual partners. There was also a significant negative association between drinking to enhance pleasure and CAS with casual partners, but none of the other drinking motives were significantly associated with CAS with casual partners. None of the alcohol-related variables were significantly associated with CAS with serious partners.

DISCUSSION

The current study examined the event-level associations among drinking motives, alcohol consumption, and sexual risk behavior in a sample of YMSM. Consistent with previous research (15, 16), there was substantial within-person variation in drinking motives across drinking episodes, highlighting the value of operationalizing drinking motives as fluctuating states. Findings support drinking motives as event-level risk factors for alcohol consumption in general (but not before sex) in this high-risk population. Specifically, YMSM drank more on days when they drank to cope, to enhance pleasure, or to be more social. There was a 53% increase in the number of drinks consumed on days when they drank to enhance pleasure, compared to a 26% increase on days when they drank to be more social and a 19% increase on days when they drank to cope. Thus, YMSM drank the most on days when their drinking was motivated by the desire to experience more pleasure. This is generally consistent with previous findings that enhancement and social facilitation motives have stronger influences on alcohol consumption than coping motives (38), although this previous study found that social facilitation motives had the strongest influence.

Several studies have found that the association between drinking to enhance pleasure and alcohol problems becomes non-significant when drinking to cope is taken into account (8, 39–41). However, the current study and one previous study of YMSM (14) found that both drinking motives were associated with alcohol use and problems, and that drinking to enhance pleasure had a stronger influence compared to drinking to cope. While previous research on drinking among YMSM has emphasized the role of drinking as a way to escape

negative feelings about one's sexual orientation, the current findings suggest that an important motivation for drinking among YMSM is to feel good and to have fun. Drinking to have fun may be particularly likely to escalate into problematic drinking in this population, given evidence that gay men drink more frequently in bars compared to heterosexual men (42, 43), sexual minorities report more tolerant substance use norms compared to heterosexuals (44), and substance use norms (e.g., perceptions of drinking as normative, tolerance of heavy drinking and illicit drug use) are associated with greater substance use among sexual minorities (45). As such, drinking to enhance pleasure may remain an important predictor of alcohol use and problems for YMSM, given the unique aspects of drinking in this population.

Findings also help to clarify inconsistent findings regarding alcohol use and sexual risk behavior. As noted, research has consistently demonstrated that illicit drug use is associated with sexual risk behavior (17–19), but findings have been inconsistent for alcohol use (17, 18) and event-level studies typically do not find a significant association between alcohol use and sexual risk behavior (21–24). Consistent with a previous event-level study (26), we found a positive association between alcohol use (in general and before sex) and CAS with casual partners, but not with serious partners. However, these findings are inconsistent with a study that found that the association between alcohol use before sex and CAS increased over the course of development for serious partners, but not casual partners (27). The two studies that found associations between alcohol use before sex and CAS with casual partners used event-level designs, which measure these behaviors for specific sexual episodes. In contrast, the study that found an association between alcohol use before sex and CAS with serious partners assessed these behaviors at a partner-by-partner level, which averages across specific sexual episodes with each partner. The partner-by-partner level analysis is confounded by factors such as changes in drinking behavior over the course of a relationship (e.g., drinking more at the beginning of a relationship and decreasing over time). In this case, it is possible that drinking and CAS co-occur, but the association may not be causal. It is unlikely that one episode of drinking would lead to CAS with a serious partner, because one's pattern of sexual behavior is likely already established. In contrast, one episode of drinking may contribute to CAS with a casual partner in which case a pattern of sexual behavior has not been established. As research continues to clarify the role of alcohol in sexual risk behavior, it will be important to consider the role of HIV-status. All of the participants in our sample were HIV-negative and there were not enough HIV-positive partners to examine the associations between alcohol use and CAS as a function of both relationship type (casual versus serious) and partner HIV-status.

Finally, drinking motives were generally not associated with CAS (with the exception of a negative association between drinking to enhance pleasure and CAS with casual partners). This is consistent with Kahler, Wray (11), who found that sexual motives for drinking were not associated with CAS among MSM. They suggested that factors such as amount of alcohol consumed and attitudes toward condom use may be more relevant to predicting CAS. Consistent with this hypothesis, we found that alcohol consumption was associated with CAS with casual partners. Thus, while drinking motives appear to be an important risk factor for alcohol use and problems, the risk does not appear to extend to sexual risk

behavior. Instead, drinking motives appear to influence alcohol consumption, which in turn influences CAS with casual partners.

Findings have important implications for the treatment of problematic drinking as well as HIV prevention among YMSM. Given that YMSM consumed more alcohol on days when they drank to cope with negative emotions, to enhance pleasure, or to be more social, they may benefit from interventions that help them recognize the role of motivation in alcohol consumption and that encourage them to consider why they are drinking on a particular occasion. Although effective interventions to reduce problematic drinking among MSM are scarce (46), studies have demonstrated that motivational interviewing (MI), an intervention that seeks to enhance motivation to reduce risk behavior and increase protective behavior, is effective for reducing substance use, including alcohol use, among MSM (47–49). Clinicians can use MI to increase awareness of drinking motives and motivation to reduce alcohol use. After raising awareness of drinking motives, clinicians can apply specific interventions that target the individual's typical drinking motive. For instance, those who drink to cope may benefit from stress reduction and coping skills training, whereas those who drink to enhance pleasure may benefit from learning alternative sources of pleasure and restructuring expectancies for alcohol's enhancing effects (8). Given that drinking to increase positive emotion was a stronger predictor of alcohol consumption compared to drinking to decrease negative emotion, interventions that focus on drinking as a coping mechanism may not be as effective for those who drink to feel good and to have fun. Instead, these individuals may require approaches that simultaneously validate their desire to drink to have fun while examining the potential risk of drinking excessively and the consequences of doing so. They may also benefit from interventions that target their perceptions of normative drinking among YMSM, which may reveal that they overestimate how much other YMSM drink. Finally, given that YMSM were more likely to engage in CAS with casual partners on days when they drank more (in general and before sex), HIV prevention programs can address the influence of alcohol on sexual risk behavior with partners for whom there are not established patterns of sexual behavior. Further, these findings speak to the importance of developing HIV prevention programming that helps YMSM navigate the contexts surrounding different sexual encounters. Risk factors for HIV acquisition differ between casual and serious partners, and we can only curb rising HIV incidence by preparing YMSM for all types of risky encounters.

The current findings must be considered in light of limitations. First, we only asked participants to report on their drinking motives on days when they drank. As such, our data can speak to whether drinking motives predict how much people drink, but not whether or not they drink. Future research could consider assessing drinking motives at the beginning of the day for all participants and then assessing whether or not people drank at the end of the day. Such a test would allow for an examination of whether drinking motives predict whether or not people drank. Additionally, there were too few participants who completed the measure of drinking motives on most days to test its psychometric properties (35). Although it is based on a measure that has established psychometric properties (34), we cannot confirm the factor structure of the measure or the internal consistencies of the subscales at the event-level. Second, there is evidence that the event-level associations between drinking motives and number of drinks consumed depend on whether the drinking

is social or nonsocial in nature. While social facilitation and enhancement motives have the most influence on social drinking, coping motives have the most influence on nonsocial drinking (16, 38, 50). Given that we did not assess whether drinking occasions were social or non-social, we were not able to test hypotheses related to differences based on social versus non-social situations. Future research should also consider social context and test whether the associations among drinking motives, alcohol consumption, and CAS differ depending on the context in which alcohol is being used (e.g., at a bar, at home). Third, participants were not provided with the definition of a standard drink, so data on the number of drinks consumed reflect each participant's perception of what constitutes a drink. Although this may affect between-person comparisons, this is unlikely to affect the within-person associations that we tested. Finally, the majority of the sample identified as gay, all participants were required to report binge drinking or illicit drug use in the past 30 days, and all participants were recruited via Facebook to participate in a randomized trial. As such, the sample is not nationally representative and findings may not generalize to all YMSM (e.g., those who do not identify as gay, those who do not endorse binge drinking or illicit drug use, and those who do not agree to participate in online studies). Despite limitations, the current study filled an important gap in the literature by examining the event-level associations among drinking motives, alcohol consumption, and sexual risk behavior in a racially/ethnically diverse sample of YMSM. The current findings demonstrate that drinking motives influence alcohol use and that alcohol use influences sexual risk behavior with casual partners at the event-level among YMSM. As such, findings highlight the need for interventions to target both drinking motives and alcohol use in order to reduce problematic drinking and sexual risk behavior.

Acknowledgments

Data collection for this study was supported by a grant from the National Institute on Drug Abuse (1R03DA035704-01; PI: Newcomb). Brian A. Feinstein's time was also supported by a grant from the National Institute on Drug Abuse (1F32DA042708-01). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute on Drug Abuse. We thank all of the participants for their contributions to this study.

Funding: This study was funded by the National Institute on Drug Abuse (1R03DA035704-01).

References

1. CDC. HIV Surveillance - Men Who Have Sex with Men. 2016. Available from: <http://www.cdc.gov/HIV/library/slidesets/index.html>
2. Hatzenbuehler ML, Corbin WR, Fromme K. Trajectories and determinants of alcohol use among LGB young adults and their heterosexual peers: Results from a prospective study. *Developmental Psychology*. 2008; 44(1):81–90. [PubMed: 18194007]
3. Marshal MP, Friedman MS, Stall R, Thompson AL. Individual trajectories of substance use in lesbian, gay and bisexual youth and heterosexual youth. *Addiction*. 2009; 104(6):974–81. [PubMed: 19344440]
4. Newcomb M, Ryan DT, Greene GJ, Garofalo R, Mustanski B. Prevalence and patterns of smoking, alcohol use, and illicit drug use in young men who have sex with men. *Drug Alcohol Depend*. 2014; 141:65–71. [PubMed: 24907774]
5. Talley AE, Hughes TL, Aranda F, Birkett M, Marshal MP. Exploring alcohol-use behaviors among heterosexual and sexual minority adolescents: intersections with sex, age, and race/ethnicity. *Am J Public Health*. 2014; 104(2):295–303. [PubMed: 24328614]

6. Marshal MP, Friedman MS, Stall R, King KM, Miles J, Gold MA, et al. Sexual orientation and adolescent substance use: A meta-analysis and methodological review. *Addiction*. 2008; 103(4): 546–56. [PubMed: 18339100]
7. Cox M, Klinger E. A motivational model of alcohol use. *Journal of Abnormal Psychology*. 1988; 97:168–80. [PubMed: 3290306]
8. Cooper ML, Frone MR, Russell M, Mudar P. Drinking to regulate positive and negative emotions: A motivational model of alcohol use. *Journal of Personality and Social Psychology*. 1995; 69(5):990–1005. [PubMed: 7473043]
9. Cooper ML, Russell M, Skinner JB, Windle M. Development and validation of a three-dimensional measure of drinking motives. *Psychological Assessment*. 1992; 4(2):123–32.
10. Kuntsche E, Knibbe R, Gmel G, Engels R. Why do young people drink? A review of drinking motives. *Clin Psychol Rev*. 2005; 25(7):841–61. [PubMed: 16095785]
11. Kahler CW, Wray TB, Pantalone DW, Mastroleo NR, Kruis RD, Mayer KH, et al. Assessing sexual motives for drinking alcohol among HIV-positive men who have sex with men. *Psychol Addict Behav*. 2015; 29(1):247–53. [PubMed: 25134043]
12. Ebersole RC, Noble JJ, Madson MB. Drinking motives, negative consequences, and protective behavioral strategies in lesbian, gay, bisexual, and transgender college students. *Journal of LGBT Issues in Counseling*. 2012; 6(4):337–52.
13. Hatzenbuehler ML, Corbin WR, Fromme K. Discrimination and alcohol-related problems among college students: a prospective examination of mediating effects. *Drug Alcohol Depend*. 2011; 115(3):213–20. [PubMed: 21145669]
14. Feinstein BA, Newcomb ME. The role of substance use motives in the associations between minority stressors and substance use problems among young men who have sex with men. 2016 Manuscript under review.
15. Arbeau KJ, Kuiken D, Wild TC. Drinking to enhance and to cope: a daily process study of motive specificity. *Addict Behav*. 2011; 36(12):1174–83. [PubMed: 21864984]
16. O'Hara RE, Armeli S, Tennen H. College students' drinking motives and social-contextual factors: Comparing associations across levels of analysis. *Psychol Addict Behav*. 2015; 29(2):420–9. [PubMed: 25546143]
17. Vosburgh HW, Mansergh G, Sullivan PS, Purcell DW. A review of the literature on event-level substance use and sexual risk behavior among men who have sex with men. *AIDS Behav*. 2012; 16(6):1394–410. [PubMed: 22323004]
18. Mustanski B, Newcomb ME, Du Bois SN, Garcia SC, Grov C. HIV in young men who have sex with men: A review of epidemiology, risk and protective factors, and interventions. *J Sex Res*. 2011; 48(2):218–53. [PubMed: 21409715]
19. Drumright LN, Patterson TL, Strathdee SA. Club drugs as causal risk factors for HIV acquisition among men who have sex with men: a review. *Subst Use Misuse*. 2006; 41(10–12):1551–601. [PubMed: 17002993]
20. Parsons JT, Lelutiu-Weinberger C, Botsko M, Golub SA. Predictors of Day-Level Sexual Risk for Young Gay and Bisexual Men. *AIDS and Behavior*. 2013; 17:1465–77. [PubMed: 22614745]
21. Mustanski B. Moderating effects of age on the alcohol and sexual risk taking association: an online daily diary study of men who have sex with men. *AIDS Behav*. 2008; 12(1):118–26. [PubMed: 18034298]
22. Newcomb ME, Clerkin EM, Mustanski B. Sensation seeking moderates the effects of alcohol and drug use prior to sex on sexual risk in young men who have sex with men. *AIDS and Behavior*. 2011; 15(3):565–75. [PubMed: 20960048]
23. Newcomb ME. Moderating effect of age on the association between alcohol use and sexual risk in MSM: evidence for elevated risk among younger MSM. *AIDS Behav*. 2013; 17(5):1746–54. [PubMed: 23553348]
24. Wells BE, Rendina HJ, Kelly BC, Golub SA, Parsons JT. Demographic Predictors of Event-Level Associations between Alcohol Consumption and Sexual Behavior. *J Urban Health*. 2016; 93(1): 155–69. [PubMed: 26678072]

25. Newcomb ME, Clerkin EM, Mustanski B. Sensation Seeking Moderates the Effects of Alcohol and Drug Use Prior to Sex on Sexual Risk in Young Men Who Have Sex with Men. *AIDS Behav.* 2011; 15:565–75. [PubMed: 20960048]
26. Venable PA, McKirnan DJ, Buchbinder SP, Bartholow BN, Douglas JM Jr, Judson FN, et al. Alcohol use and high-risk sexual behavior among men who have sex with men: the effects of consumption level and partner type. *Health Psychol.* 2004; 23(5):525–32. [PubMed: 15367072]
27. Newcomb ME, Mustanski B. Developmental change in the relationship between alcohol and drug use before sex and sexual risk behavior in young men who have sex with men. *AIDS Behav.* 2014; 18(10):1981–90. [PubMed: 24696227]
28. Newcomb ME, Swann G, Estabrook R, Corden M, Begale M, Ashbeck A, et al. Patterns and Predictors of Compliance in a Prospective Diary Study of Substance Use and Sexual Behavior in a Sample of Young Men Who Have Sex with Men. *Assessment.* in press.
29. National Institute on Alcohol Abuse and Alcoholism. Drinking Levels Defined. Available from: <https://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/moderate-binge-drinking>
30. Mustanski B. Ethical and regulatory issues with conducting sexuality research with LGBT adolescents: a call to action for a scientifically informed approach. *Archives of Sexual Behavior.* 2011; 40:673–86. [PubMed: 21528402]
31. Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption--II. *Addiction.* 1993; 88(6):791–804. [PubMed: 8329970]
32. Babor, TF., Higgins-Biddle, JC., Saunders, JB., Monteiro, MG. *The Alcohol Use Disorders Identification Test: guidelines for use in primary health care.* Geneva, Switzerland: World Health Organization; 2001.
33. Adamson SJ, Kay-Lambkin FJ, Baker AL, Lewin TJ, Thornton L, Kelly BJ, et al. An improved brief measure of cannabis misuse: the Cannabis Use Disorders Identification Test-Revised (CUDIT-R). *Drug Alcohol Depend.* 2010; 110(1–2):137–43. [PubMed: 20347232]
34. Kuntsche E, Kuntsche S. Development and Validation of the Drinking Motive Questionnaire Revised Short Form (DMQ-R SF). *Journal of Clinical Child & Adolescent Psychology.* 2009; 38(6):899–908. [PubMed: 20183672]
35. Rouquette A, Falissard B. Sample size requirements for the internal validation of psychiatric scales. *Int J Methods Psychiatr Res.* 2011; 20(4):235–49. [PubMed: 22020761]
36. Reifman, A., Keyton, K. Winsorize. In: Salkind, NJ., editor. *Encyclopedia of Research Design.* Thousand Oaks, CA: Sage; 2010. p. 1636-8.
37. Feinstein BA, Newcomb ME. The role of substance use motives in the associations between minority stressors and substance use problems among young men who have sex with men. *Psychol Sex Orientat Gend Divers.* 2016; 3(3):357–66. [PubMed: 27713906]
38. O'Hara RE, Boynton MH, Scott DM, Armeli S, Tennen H, Williams C, et al. Drinking to cope among African American college students: an assessment of episode-specific motives. *Psychol Addict Behav.* 2014; 28(3):671–81. [PubMed: 25134052]
39. Carey KB, Correia CJ. Drinking motives predict alcohol-related problems in college students. *J Stud Alcohol.* 1997; 58(1):100–5. [PubMed: 8979218]
40. Kassel JD, Jackson SI, Unrod M. Generalized expectancies for negative mood regulation and problem drinking among college students. *Journal of Studies on Alcohol.* 2000; 61(2):332–40. [PubMed: 10757145]
41. Lindgren KP, Neighbors C, Blayney JA, Mullins PM, Kaysen D. Do drinking motives mediate the association between sexual assault and problem drinking? *Addict Behav.* 2012; 37(3):323–6. [PubMed: 22094169]
42. Trocki KF, Drabble L, Midanik L. Use of heavier drinking contexts among heterosexuals, homosexuals and bisexuals: results from a National Household Probability Survey. *J Stud Alcohol.* 2005; 66(1):105–10. [PubMed: 15830910]
43. Coulter RW, Marzell M, Saltz R, Stall R, Mair C. Sexual-orientation differences in drinking patterns and use of drinking contexts among college students. *Drug Alcohol Depend.* 2016; 160:197–204. [PubMed: 26827292]

44. Cochran SD, Grella CE, Mays VM. Do substance use norms and perceived drug availability mediate sexual orientation differences in patterns of substance use? Results from the California Quality of Life Survey II. *Journal of studies on alcohol and drugs*. 2012; 73(4):675–85. [PubMed: 22630806]
45. Hamilton CJ, Mahalik JR. Minority stress, masculinity, and social norms predicting gay men's health risk behaviors. *Journal of Counseling Psychology*. 2009; 56:132–41.
46. Wray TB, Grin B, Dorfman L, Glynn TR, Kahler CW, Marshall BD, et al. Systematic review of interventions to reduce problematic alcohol use in men who have sex with men. *Drug and alcohol review*. 2016; 35(2):148–57. [PubMed: 25866929]
47. Lelutiu-Weinberger C, Pachankis JE, Gamarel KE, Surace A, Golub SA, Parsons JT. Feasibility, Acceptability, and Preliminary Efficacy of a Live-Chat Social Media Intervention to Reduce HIV Risk Among Young Men Who Have Sex With Men. *AIDS Behav*. 2015; 19(7):1214–27. [PubMed: 25256808]
48. Morgenstern J, Irwin TW, Wainberg ML, Parsons JT, Muench F, Bux DA Jr, et al. A randomized controlled trial of goal choice interventions for alcohol use disorders among men who have sex with men. *J Consult Clin Psychol*. 2007; 75(1):72–84. [PubMed: 17295566]
49. Parsons JT, Lelutiu-Weinberger C, Botsko M, Golub SA. A randomized controlled trial utilizing motivational interviewing to reduce HIV risk and drug use in young gay and bisexual men. *J Consult Clin Psychol*. 2014; 82(1):9–18. [PubMed: 24364800]
50. Armeli S, O'Hara RE, Ehrenberg E, Sullivan TP, Tennen H. Episode-specific drinking-to-cope motivation, daily mood, and fatigue-related symptoms among college students. *Journal of studies on alcohol and drugs*. 2014; 75(5):766–74. [PubMed: 25208194]

Table 1Demographic characteristics of the sample ($N = 189^a$).

Demographic characteristic	Mean (SD) or Percent
Age	22.96 (3.08)
Sexual orientation	
Gay	85.7%
Bisexual	13.2%
Other	1.1%
Race/ethnicity	
White	45.0%
Hispanic/Latino	25.9%
Black/African American	20.1%
Asian/Pacific Islander	1.1%
Native American	.5%
Multi-racial	6.3%
Other	1.1%
Highest level of education	
Did not complete high school	6.3%
High school	70.4%
Two-year college degree	5.8%
Four-year college degree	14.3%
Graduate degree	3.2%
HIV status	
Negative	83.1%
I don't know	16.9%
Current student	42.3%
Currently employed	70.2%
Geographic region	
Northeast	18.0%
Midwest	24.9%
South	34.4%
West	22.8%

^aOne participant did not provide data for employment.

Table II

Event-level associations between drinking motives and alcohol consumption.

Variable	Coefficient	ERR ^a	95% CI ^b	Coefficient	ERR ^a	95% CI ^b
Simultaneous Predictors						
Individual Predictors						
Number of drinks consumed ^c						
Drinking to cope	.18	1.20	1.07, 1.35	.17	1.19	1.07, 1.33
Drinking to enhance pleasure	.42	1.53	1.30, 1.80	.43	1.53	1.31, 1.79
Drinking to be more social	.28	1.32	1.16, 1.51	.23	1.26	1.13, 1.40
Drinking to enhance sex	.13	1.14	.95, 1.37	.10	1.10	.90, 1.40
Number of drinks consumed before sex ^c						
Drinking to cope	.18	1.19	1.00, 1.43	.16	1.17	.97, 1.42
Drinking to enhance pleasure	.04	1.04	.79, 1.38	.05	1.05	.79, 1.38
Drinking to be more social	.14	1.15	.91, 1.46	.09	1.10	.85, 1.42
Drinking to enhance sex	.04	1.04	.77, 1.41	-.02	.98	.71, 1.36

^aERR = Estimated Risk Ratio;

^b95% CI = 95% Confidence Interval (those that do not include 1 are significant at $p < .05$, represented in bold font);

^cOutcome variables are modeled as Poisson distributions and results are from unit-specific models with robust standard errors.

Table III

Event-level associations between drinking motives, alcohol consumption, and condomless anal sex (CAS).

Variable	Coefficient	OR ^a	95% CI ^b	Coefficient	OR ^a	95% CI ^b
Simultaneous Predictors						
Individual Predictors						
CAS with casual partners ^c						
Number of drinks consumed	.15	1.17	1.03, 1.32	-	-	-
Number of drinks consumed before sex	.18	1.20	1.01, 1.43	-	-	-
Drinking to cope	-.14	.87	.31, 2.44	-.13	.88	.26, 3.01
Drinking to enhance pleasure	-.11	.33	.11, 1.02	-1.17	.31	.10, .97
Drinking to be more social	.51	1.67	.53, 5.27	.78	2.18	.60, 7.90
Drinking to enhance sex	-.17	.84	.23, 3.14	-.28	.75	.15, 3.67
CAS with serious partners ^d						
Number of drinks consumed	0.04	1.04	0.86, 1.27	-	-	-
Number of drinks consumed before sex	0.09	1.10	0.76, 1.59	-	-	-
Drinking to cope	1.38	3.97	.95, 16.64	1.48	4.41	0.84, 23.14
Drinking to enhance pleasure	0.70	2.01	0.52, 7.75	0.69	2.00	0.45, 8.94
Drinking to be more social	0.23	1.26	0.25, 6.31	-0.36	0.70	0.09, 5.45
Drinking to enhance sex	-0.80	0.45	0.07, 3.13	-1.14	0.32	0.04, 2.59

^aOR = Odds Ratio;

^b95% CI = 95% Confidence Interval (those that do not include 1 are significant at $p < .05$, represented in bold font);

^cCAS with casual partners was modeled using a Bernoulli distribution correcting for over dispersion and results are from unit-specific models with robust standard errors;

^dCAS with serious partners was modeled using a Bernoulli distribution, results are from unit-specific models with robust standard errors, and feedback condition was included as a covariate (because it was significantly associated with CAS with serious partners in a bivariate analysis).