

RUNNING HEAD: Alcohol and risky sex among MSM

Moderating effects of age on the alcohol and sexual risk taking association:
An online daily diary study of men who have sex with men

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Abstract

Men who have sex with men (MSM) account for the majority of HIV/AIDS diagnoses and data suggest infection rates are rising. Identification of factors that increase the risk of infection is key to the development of effective prevention programs. Previous research has been inconsistent regarding the link between alcohol consumption and sexual risk taking among MSM. Daily reports of alcohol consumption and sexual behavior were completed for up to 30 days by 143 HIV negative MSM recruited online. This resulted in 2,887 daily reports of number of sex partners and 549 episodes of sex. Independent variables included age, number of standard drinks consumed, and partner type. Outcome variables included sex with a partner, a composite sexual risk variable, and unprotected anal intercourse (UAI). Alcohol consumption significantly increased the odds of having sex and had a significant positive association with the sexual risk composite variable. Age was a significant moderator of the association between alcohol consumption and sexual risk taking, with the effects of alcohol increasing with age. For example, at the 75%tile of age (37 years old), the odds of UAI increase from approximately .2 to .35 as the number of alcoholic drinks increases from zero to seven. Partner type did not have significant effects. Daily reports of alcohol consumption had a significant within-person association with sexual risk behaviors, particularly among older MSM. Findings highlight the importance of measuring individual differences as moderators of the association between alcohol and risky sexual behavior.

Men who have sex with men (MSM) experience substantial HIV health disparities. MSM accounted for 70% of all estimated HIV infection among male adults and adolescents in 2004, even though only 5-7% of men identify themselves as MSM (CDC, 2006). One population-based study of MSM in California conducted in 2001 found an HIV prevalence of 19.1% (Xia et al., 2006). A resurgence of syphilis among MSM (Peterman and Furness, 2007), coupled with increasing numbers of HIV diagnoses (CDC, 2006), suggest that HIV transmission may be increasing among MSM. In the absence of an effective vaccine, behavioral intervention to reduce risky sexual behavior remains the primary means of reducing transmission. Such interventions have the greatest likelihood for success when they target factors found to increase risk for HIV infection within a particular population.

Alcohol use is perhaps one of the most widely studied potential contributors to risky sex among MSM and other populations. In the past 20 years, hundreds of studies have been conducted on the association among alcohol consumption and risky sex (Cooper, 2006; Hendershot and George, 2007), and treatment of substance abuse has been advocated as an HIV prevention approach for substance-using MSM (e.g. Shoptaw and Frosch, 2000). Despite all of this research, there is still lack of clarity about the association between drinking and risky sex, particularly among MSM. Targeting drinking as a means of reducing HIV risk will only be effective if drinking has a causal effect—even indirectly—on risky behavior. Therefore, evaluating the nature of the alcohol-HIV risk association is of clear public health significance.

Naturalistic research on the association between alcohol and sexual risk taking has been conducted using one or more of three approaches: global associations, situation-matched correlations, and multiple event within-person associations. Global association studies examine the link between reports of average frequency of alcohol consumption and frequency of risky sex, and typically a positive relationship has been found in general samples (Cooper, 2002; Weinhardt and Carey, 2000) and among MSM (Hays et al., 1997; Hirshfield, Remien, Humberstone, Walavalkar, and Chiasson, 2004). In fact, one study identified heavy drinking as a predictor of HIV seroconversion among MSM (Koblin et al., 2006). However, these studies suffer from numerous methodological limitations, chiefly that the assessment of risky sex and alcohol use does not connect these two behaviors to the same occasion. This lack of a temporal link substantially limits the ability of these studies to inform the causal effects of alcohol consumption on risky sex.

The second methodological approach involves assessing drinking during a particular episode of sexual behavior (e.g. at last sex), and then estimating the between-person correlation of temporally matched drinking and riskiness of sexual behavior. Two recent reviews of studies using this approach (largely in young heterosexual samples) concluded that the data support an association between alcohol consumption and non-condom use at first sex, but not at most recent sex (Cooper, 2002; Leigh, 2002). Given the effect of drinking was found for first sex, it is not surprising that these reviews also suggested the effect was present in younger, but not older samples. One limitation of this approach is that it confounds stable individual differences and situational effects with putative causal effects of alcohol. Some researchers have attempted to control for stable individual differences by controlling for aspects of personality linked to both drinking and sexual behavior; one study of MSM found sensation seeking to account for the entire relationship (Kalichman, Heckman, and Kelly, 1996). Others have drawn on alcohol myopia theory (Steele and Josephs, 1990), to suggest that impairment due to alcohol intoxication promotes risky behavior only in situations where there is a high response conflict between appetitive urges for sex and inhibitory fears of risk. For example, one study found that alcohol predicted risky sex only when participants felt conflict about using a condom (Dermen and Cooper, 2000).

An improvement upon the situation-matched design involves assessment of multiple occasions of drinking and sex within the same person over time, which allows for partial disentanglement of the effects of individual differences. Studies of MSM using this approach have produced mixed results. Two daily diary studies found that unprotected sex was not significantly more common when it was preceded by drinking (Gillmore et al., 2002; Weatherburn et al., 1993). One study of alcohol and condom use for last three partners found that consumption of six or more drinks significantly increased risk of unprotected anal sex (Colfax et al., 2004). Another study that assessed last sex across two occasions found no main effect of alcohol consumption, but a significant alcohol by partner type interaction such that alcohol consumption increased high-risk sex only when it occurred with nonprimary partners (Vanable et al., 2004). Finally, a timeline followback study found that unprotected sex was more common during episodes of alcohol consumption compared to when alcohol was not consumed (Irwin, Morgenstern, Parsons, Wainberg, and Labouvie, 2006). One potential explanation for the

inconsistency in results may be unmeasured factors that moderate the relationship between alcohol and risky sex.

In a recent review of the literature on alcohol and sexuality, Cooper (2006) concluded that rather than focusing on determining if there is an association between drinking and risky sex, future research should focus on delineating under what conditions and for whom there is an association. The goal of the present article is to study the association between alcohol consumption and risky sexual behavior using daily diary data from a sample of MSM. In addition to helping to resolve the inconsistent association between alcohol consumption and HIV risk behaviors among MSM, a moderator of the link is also tested. The existing literature provides some direction for what factors may moderate the effects of alcohol use on risky sexual behavior. Meta-analytic data suggest that the effects of alcohol on risky sexual behavior are more robust in younger samples (Cooper, 2002; Leigh, 2002). It has been hypothesized that this age effect is due to youth having more limited experience with sex and alcohol, which could increase ambivalence towards risky sex and allow for disinhibitory influences of alcohol on sexual decision making (Cooper, 2002). It was therefore hypothesized that age would negatively moderate the association between alcohol and HIV risk behaviors (i.e. the association will be larger in younger participants).

Studies have also identified interactions between alcohol consumption and partner type (i.e. casual/new or serious/repeat partner) in predicting risky sex (Fortenberry, Orr, Katz, and Brizendine, 1995; Vanable et al., 2004). In general, recent studies have found that risky sex is less likely to occur with casual partners compared to serious partners, but that alcohol exerts a stronger effect with new partners. Consistent with previous research (Hunt et al., 1993; Misovich, Fisher, and Fisher, 1997), it was hypothesized that less risky sex would occur with new partners and that alcohol would exert a greater effect on risky sex with new partners. In statistical terms, it is hypothesized that partner type (i.e. prior partner = 0, new partner = 1) will have a negative main effect on sexual risk variables and that alcohol will use will have a significant interaction with partner type.

This study capitalizes on the fact that daily diary research allows for the collection of detailed reports of sexual behaviors on a specific day. This allows for the creation of a composite variable that combines risk information across multiple behaviors on the same day, thereby creating a dimension from low to high risk behavior that may have greater analytic

power relative to a dichotomous single-behavior variable. At the same time, a composite measure results in a certain level of abstraction across behaviors that vary in terms of real and perceived HIV risk, and can also limit comparability of findings to studies that report on specific HIV risk behaviors. Given the advantages and disadvantages of composite and behavior-specific outcome variables, both approaches are taken. Outcome variables include: if the participant had a sex partner on a particular day, a composite HIV risk behavior variable, and a dichotomous unprotected anal intercourse (UAI) variable. The use of these three outcome variables allows for exploration of the effects of alcohol across multiple aspects of sexual risk taking.

Methods

Sample and Procedure

Here we report a subset of the data collected from a daily diary study focused on contextual risk factors for HIV among MSM (Mustanski, 2007a, 2007b; Mustanski, 2004). MSM were recruited via a number of websites: a comprehensive list of gay and lesbian university organizations (Mustanski, 2001), a high volume website for MSM looking for casual sex, a website about “sex addiction,” and the website of the Kinsey Institute. Participants were recruited using the Internet because it is an efficient means of identifying a sample of MSM who regularly use the Internet, therefore making it feasible for them to complete online daily diaries. After viewing an informed consent statement, participants completed a set of initial questionnaires and within several weeks began completing quantitative diaries online each night for up to 30 days. As tested in a pilot phase, diaries took approximately five minutes to complete. Participants were given the opportunity to receive either automatic daily e-mail reminders or e-mail reminders only on the day after they failed to complete a diary entry. The diary instructions requested that participants complete their online dairies each night before midnight. The diary program documented the date and time when subjects submitted their diary entries, and after three AM it automatically switched to the next day. Participants received \$1 for each diary entry completed and a \$10 bonus if they completed at least 28 dairies. At the end of the study, participants were asked to provide their full name and address so that they could be compensated by a check through the mail. They were also given the option of maintaining their anonymity by not receiving compensation for their participation. This prevented the possibility of repeat participation to collect additional compensation.

Several procedures were undertaken to protect participant confidentiality. At the conclusion of the first set of online questionnaires, participants were invited to provide an e-mail address if they were interested in hearing more about the online diary study. This webpage also included a link to set up a free e-mail account if participants did not want to use an account that would identify them. At the start of the diary study, participants were invited to create a non-identifying username that would be used to log into the diary and for tracking purposes. All webpages were maintained on a secure server that encrypted data during transmission. All e-mail interactions occurred using a research e-mail account. At the end of the study all of these correspondences and participant e-mail addresses were destroyed. The study was approved by the Institutional Review Board (IRB).

The full sample included 155 MSM with a mean age of 28.7 (SD = 10.3) years. The sample was generally highly educated (53.4% completed some college and 39.2% completed college). In regards to employment, 34.9% were employed full time and 37.6% were students, with the remaining employed part-time or unemployed. Eighty-six percent of the sample described themselves as “White,” 4.7% as “Black,” 2.7% as “Hispanic,” and the rest as “Other;” 15.5% of the sample identified as “bisexual,” with the rest identifying as “gay/homosexual.” In terms of recruitment sources, 19.3% of the sample was recruited via student organizations and 80.7% was recruited from the banner advertisements.

Measures

Between-subject measures (level 2).

Participants were asked their age in years and if they ever received a positive HIV test result.

Within-Subject Measures (level 1).

In the online diary, participants reported the number of standard alcoholic drinks that they had on the previous day, with a drink defined as equal to one glass of wine, a beer, a mixed drink, or a shot. Responses were regarding the previous day to assure the opportunity for all occasions of behavior to be reported. Participants reported the number of sexual partners, and then reported on specific sexual behaviors (e.g. “Did you put your mouth on his penis?”) that occurred with each sexual partner for the prior day, as well as if a condom was used for each behavior. Consistent with past research (Mustanski 2007a; 2007b) this information was used to calculate three sexual risk outcome variables. First, the initial report of number of partners was

recoded into a dichotomous variable (*sex partner*) of no partner (0) or one or more partners (1). Second, a composite sexual risk behavior variable was created through a consensus meeting with several sexual health researchers: 0 = hand-genital contact; 0 = gave or received oral sex with a condom; 1 = anal sex with a condom; 1 = received oral sex without a condom; 2 = gave oral sex without a condom; 4 = unprotected insertive anal sex (“top”); 7 = unprotected receptive anal intercourse (“bottom”) (see Mustanski, 2007b for more details). Third, a dichotomous behavior-specific variable was also computed from these responses; unprotected anal intercourse (UAI) = 1, versus other safer sex behaviors = 0 (including protected anal intercourse and oral or manual sex). Participants also reported on the number of times they had previously had sex with each partner, which was recoded to one (1) for new partners and zero (0) for past partners. This variable is referred to as “partner type” in future analyses.

Analyses

Multilevel modeling using HLM v 6.0 (Raudenbush and Bryk, 2002) was used to analyze the daily diary data. Multilevel modeling is an analytic procedure developed to account for the dependency in observations when data has a nested, multilevel structure such as days (level-1) nested within person (level-2). In this case, the relationship between drinking and sexual risk is modeled for each participant (level 1) with the average relationship across participants simultaneously estimated (level 2). It is also possible to include level-2 variables in the model to account for differences between participants. Here, age was included in a series of models (at level 2) to account for differences between participants in sexual risk taking. Level 2 variables can also be included as moderators of level-1 relationships (i.e. cross-level interaction; Raudenbush and Bryk, 2002). These cross-level interaction terms statistically test for linear differences in the alcohol-sexual risk taking relationship across the range of a particular level-2 variable. Cross-level interaction terms were used to test the hypothesis that alcohol exerted a stronger effect on risky sexual behavior among younger participants (i.e. age negatively moderated the relationship between alcohol and risky sexual behavior). Age was grand mean centered so that estimates of intercepts and slopes are for participants with mean age.

Maximum likelihood estimation was used to model the sexual risk taking composite variable as the dependent variable. For the dichotomous outcomes (*sex partner* and UAI), the Bernoulli model with Laplace estimation was used as recommended by Raudenbush and Bryk (2002). The Bernoulli model is a special case of the binomial distribution when the outcome

variable can take on the values of either zero or unity. This model produces estimates of the odds of the outcome and the odds ratio for the effects of independent variables. P-values were estimated using robust standard errors.

Results

Twelve men reported an HIV positive status and were removed from these analyses. In the sample of 143 HIV negative MSM, the mean number of diaries completed was 24.17 (SD = 10.04; 70% completed at least 20 diaries), for a total of 3,563 recorded diary entries. These reports included 2,887 reports of if the participant had one or more sex partner(s) on that particular day, with one or more partners reported on 549 days (19% of days) of dairies. Participants reported drinking on 23% of days, and on days in which drinking occurred the mean number of standard drinks was 3.04 (SE = .14). No association was found between age and alcohol consumption reported in diaries ($T = .74$, $\sim df = 141$, $p = .46$).

The results of the hierarchical model predicting having one or more sex partners are shown in Table 1. In the row labeled “L1 Intercept,” the estimate of .20 represents the odds of having a sex partner for a participant of mean age, on days when zero drinks were consumed. The main effect of alcohol was estimated as OR = 1.18, which indicates an 18% increase in the odds of having a sex partner for each alcoholic drink consumed. The between-person effect of age was not significant in this model, nor was the cross-level interaction effect of age.

Insert Table 1 about here.

The next set of analyses focused on the sexual risk taking composite variable. In order to appropriately include the partner type variable into the analyses, the sexual risk composite was initially calculated to only include risk behavior data from the first sexual partner reported on any given day. To be included in these analyses, participants were required to have had at least one sexual partner reported in their diaries, which limited the sample to 100 participants with adequate data. Among the 100 participants with adequate data, sex with a new partner occurred on 27% of sexual encounters. The first model fit to the data only included the sexual risk taking composite variable, in order to estimate the variance at each level of the model (level 1 variance component = 8.42; level 2 = 6.20; Chi square = 466.07, DF = 99, $p < .001$), which resulted in an interclass correlation of 0.42. This indicates that a slightly greater proportion of the variance in daily reports of sexual risk taking is within- instead of between-subjects. Next, a model was fit that included quantity of alcohol consumed as a predictor of risky sexual behavior (coefficient =

.12, SE = .07, $p = .09$). There was a statistical trend for each standard drink to increase the sexual risk composite score by .12. Next, a model was fit with partner type included along with alcohol consumption at level 1. Only the main effect of partner type could be included because the low number of days in which drinking occurred with a new partner made power to detect an interaction term too low to be included in the model. The effect of partner type was not significant (coefficient = -.01, SE = .40, $p = .97$), and was therefore excluded from future models.

The exclusion of partner type from the model allowed for the sexual risk composite variables to be calculated for sexual risk behaviors across all partners reported on a given day. Table 2 reports the results of the model for this outcome, which also included the main effects of age and the cross-level interaction between age at level 2 and alcohol consumption at level 1. This cross level interaction tested if differences in age moderated the association between drinking and risky sexual behavior. As shown in Table 2, the model estimated the mean sexual risk taking composite score for a participant of mean age, on a day when no alcohol was consumed, to be 4.28. Daily reports of alcohol consumption were significantly associated with daily reports of sexual risk taking; for participants with the mean age for the sample (i.e. early adulthood), each alcoholic drink consumed increased the composite sexual risk taking score by .29 units. Age did not have a significant main effect on sexual risk taking, but it was a significant moderator of the association between daily reports of alcohol consumption and risky sexual behavior. Figure 1 illustrates the association between alcohol consumption and risky sexual behavior for participants at the 25th percentile for age (approximately 20 years old) and 75th percentile for age (approximately 37 years old). The association was stronger among participants of older age and there was almost no effect in young participants. In older participants, the mean sexual risk taking score increased from approximately 4 to 8.5 as the number of drinks consumed went from zero to seven, which is a meaningful change given the scale of the dependent variable (i.e. change of approximately one standard deviation).

Insert Table 2 about here.

Insert Figure 1 about here.

Table 3 reports results for the dichotomous UAI outcome variable. The intercept estimate of 0.36 represents the odds of UAI during an episode of sex for participants of mean age on days in which no alcohol was consumed. In this analysis, alcohol consumption did not have a

significant within-person main effect on UAI, but age was a significant moderator of this effect. While the odds ratio for the cross-level interaction (i.e. 1.01), may seem small, it must be interpreted within the context of the large age range within the sample; each year of age results in a 1% increase in the odds ratio for the relationship between alcohol consumption and UAI. This relationship is shown in Figure 2 for participants at the 25th and 75th percentiles.

Insert Table 3 about here.

Insert Figure 2 about here.

Discussion

The aim of these analyses was to examine the association between alcohol consumption and risky sexual behavior among MSM, a population particularly vulnerable to HIV and other STIs. A daily diary design was utilized to overcome some of the methodological limitations that existed in past research. The daily diary approach establishes a temporal connection between alcohol consumption and sexual behavior, as reports are taken on the same day. Furthermore, it allows for estimation of within-person associations between alcohol consumption and sexual behavior, which are free of the effects of stable individual differences. Of course individual difference can still exert their effects on the overall rate of individual sexual risk behavior or moderate the alcohol and risky-sex association. Results suggested that on average, each alcoholic drink consumed increased the odds of having a sexual partner on a particular day by 18%. Number of alcohol drinks consumed on a given day was also significantly positively related to the composite sexual risk taking variable. Alcohol consumption did not have a significant main effect on the behavior specific outcome of unprotected anal intercourse, but it is important to keep in mind that power is lower to detect a significant effect with a binary outcome.

Previous studies using event-level designs with MSM have produced inconsistent results regarding the association between alcohol and sexual risk taking (Colfax et al., 2004; Gold and Skinner, 1992; Gillmore et al., 2002; Irwin et al., 2006; Vanable et al., 2004; Weatherburn et al., 1993). Novel analyses were conducted to potentially explain these past inconsistent findings by including age as a moderator of the alcohol-risky sex association. Results suggest that in this sample of MSM, alcohol consumption was most related to risky sexual behavior in the older portion of the sample. In other words, the effects of alcohol on risky sex may not be universal

and may increase with age among MSM. Given that the same participants were not studied at multiple ages, it is impossible to know if this is a developmental effect or a cohort effect.

Interestingly, in reviewing previously published event-level studies on the association between alcohol and sexual risk taking, some positive results were reported in studies with a sample mean age greater than 30 (Colfax et al., 2004; Irwin et al., 2006; Venable et al., 2004), whereas negative results were reported with younger participants (Gold and Skinner, 1992; Gillmore et al., 2002). The exception to this pattern is the study by Weatherburn et al (1993), which reported no significant association in a sample with a mean age of 32 (A. Coxon, personal communication, October 29, 2007). Although a formal meta-analysis is required to test the significance of sample age differences in effect sizes across studies, this pattern is generally consistent with the within-person interaction reported here. This convergence of evidence is suggestive that indeed alcohol may exert a larger effect among older MSM relative to their younger counterparts, although more research remains to be done to provide a definitive answer.

This pattern of findings among MSM is inconsistent with past meta-analytic research from largely heterosexual samples, which generally have found alcohol to have a larger effect in younger samples (Cooper, 2002; Leigh, 2002). Past explanations for this age effect have focused on youth as novices at sex and drinking, which limits their knowledge and experience, increases ambivalence, and thereby allows alcohol to exert a disinhibitory influence on their sexual decision making (Cooper, 2002). If the moderating effect of age is in fact negative among heterosexuals and positive among MSM, what could explain this difference in the effect of alcohol on sexual risk behavior? Several posteriori explanations exist. First, it is possible that changes in drinking behaviors (i.e. quantity, frequency, settings) that occur with age differ by sexual orientation and that these factors underlie the association between alcohol and sexual risk taking. Studies of adults have found that alcohol consumption rates among gay men do not seem to decrease with age as quickly as they do among heterosexuals (McKirnan & Peterson, 1989; Skinner, 1994; Stall & Wiley, 1988), where use of alcohol tends to peak between 18 to 25 years of age (Kandel, Chen, Warner, Kessler, & Grant, 1997). Differences in alcohol quantity by age were not significant in this study, but it is possible that norms and environmental factors related to drinking do differ by age, such that in older gay men settings or occasions where drinking occur are more sexualized. A second possibility is that “AIDS burnout” is more common among older MSM, who have more years of exposure to prevention messages and maintained effort at

safer sex for a longer period of time (Wolitski, Valdiserri, Denning, and Levine, 2001). This burnout may increase ambivalence towards safer sex behaviors. According to alcohol myopia theory (Steele and Josephs, 1990), alcohol affects behavior when that behavior is controlled by competing cues of nearly equal strength. Therefore, ambivalent attitudes towards safer sex represent an ideal condition for alcohol to exert an effect on sexual risk taking. “AIDS burnout” can be expected to be much less common among heterosexuals, and therefore is one potential explanation for these differing patterns by sexual orientation. Other possible explanations for these sexual orientation differences include differential susceptibility to alcohol-related cognitive impairment or to alcohol-related erectile dysfunction, differences in the characteristics of adults who participate in research based on sexual orientation, among others. Further research is needed to replicate these findings and to begin identifying the processes that mediate the moderating effect of age.

In contrast to the hypothesis, partner type did not show a significant effect on sexual risk taking. Past research has suggested that gay men are less likely to use condoms with regular partners than with casual partners (Hunt et al., 1993; Misovich et al., 1997). One reason this effect was not found in the current study could be the measurement of relationship type, which was defined as a new or prior partner. This relatively crude measure of relationship type collapses together prior partners that may be quite distinct: primary partners, repeat casual partners, repeat paying partners, and ex-boyfriends revisited are just a few examples. Future studies would benefit from a more sophisticated assessment of relationship factors. This study was also unable to test for the level-1 interaction between partner type and alcohol consumption because of too few data points in particular cells. Prior studies that reported interactions between partner type and alcohol consumption either used longer diary data collection periods that allowed for more kinds of partners to be assessed (Fortenberry et al., 1995) or a much larger sample, but fewer observations of behavior (Venable et al., 2004). Future studies could use either of these approaches, or could purposefully stratify recruitment based on partner type, which would allow for partner type to be included as a between-person (level-2) factor. The interaction effect of partner type and alcohol consumption is not well established (e.g. Fortenberry et al., 1995; Fortenberry, Orr, Katz, Brizendine, and Blythe, 1997) and should continue to be investigated.

While several important and novel findings emerged from this project, they must be interpreted within the context of limitations. First and foremost, this project was based on a non-representative sample of MSM, which may limit generalizability. However, representative samples of MSM are almost impossible to achieve and the Internet has proven a useful means of recruiting this population (Mustanski, 2006; Ross, Tikkanen, and Mansson, 2000). Second, despite the fact that Internet-based research can result in valid data collection (Gosling, Vazire, Srivastava, and John, 2004) and the demographics of Internet users are increasingly representative of Americans (Pew Internet & American Life Project, 2003), these data were collected via the Internet and may have been the source of the skewing of this sample towards higher educated, Caucasian participants. Third, we did not assess drug use, which overlaps with alcohol use in some individuals. Finally, we did not assess other differences between participants that could have been included in the model as level-2 factors, such as degree of interest in casual sex, safer sex ambivalence, or other factors that could have had explanatory power.

The nature of the association between alcohol use and sexual risk taking has important implications for HIV prevention with MSM. If acute alcohol consumption has a temporal and causal effect on risky sexual behavior, then interventions that reduce the frequency of alcohol consumption would reduce HIV transmission. If no such relationship exists, then falsely informing MSM that alcohol causes risky sexual behavior may provide them with a justification for engaging in risky sex or take time and resources away from more important and relevant issues (Weatherburn et al., 1993). These data suggest that the question should not be *if* alcohol influences sexual risk taking among MSM, but instead *for which MSM*. In this case, age was an important moderator of the relationship between alcohol and sexual risk taking. This type of complexity in basic research can make it difficult to translate findings into public health practice, but in fact it is consistent with the trend in HIV prevention research towards tailoring interventions to specific subpopulations (McKleroy et al., 2006). Much of this tailoring has focused on ethnicity and age, and these data support the importance of considering age when intervening on alcohol use as a means of reducing HIV risk among MSM. This study illustrates one methodological approach (online daily diaries) that has substantial potential for identifying individual differences that may moderate the effects of event level factors on HIV risk behaviors. The use of an online data collection approach also highlights a potential method of incorporating

more detailed tailoring of intervention materials to participants. In many offline HIV prevention interventions (e.g. group-based, media campaigns), it is difficult to tailor content to individual differences in participants, but more in-depth tailoring can be automated in Internet-based interventions (Klausner, Levine, and Ken, 2004; McFarlane, Kachur, Klausner, Roland, and Cohen, 2005; Mustanski, 2006).

In summary, this study implicated individual differences in age as a moderator of the relationships between alcohol consumption and risky sex among MSM. The importance of these individual differences may help explain why prior studies have produced inconsistent results regarding this association. Future multiple event-level studies should include assessment of individual difference and test for their moderating effects. If the moderating effects of age found in this investigation are replicated, alcohol consumption should be considered as a plausible candidate for HIV prevention interventions targeting early adult and older MSM.

Table 1: HLM estimation of the association between alcohol consumption and having a sex partner moderated by age.

Effect	Odds Ratio	95% CI	P-value
L1 Intercept	.20	0.16 - 0.26	< .001
L1 Main effect of Alcohol	1.18	1.11 – 1.26	< .001
L2 Main effect of Age	1.01	0.99 – 1.04	.29
L2 Moderating effect of Age	1.01	1.00 – 1.01	.12

Note: L1= Level 1 of the model (i.e. within-person); L2 = Level 2 of the model (i.e. between-person). L1 Intercept represents the estimate of the mean of the outcome variable holding all other model parameters at zero. L2 main effects are grand mean centered.

Table 2: HLM estimation of effect of alcohol consumption on risky sexual behavior and moderation by age.

Effect	Coefficient	Standard Error	P-value
L1 Intercept	4.28	0.34	<.001
L1 Main effect of Alcohol	0.29	0.09	<.01
L2 Main effect of Age	-0.02	0.03	.67
L2 Moderating effect of Age	0.04	0.01	<.001

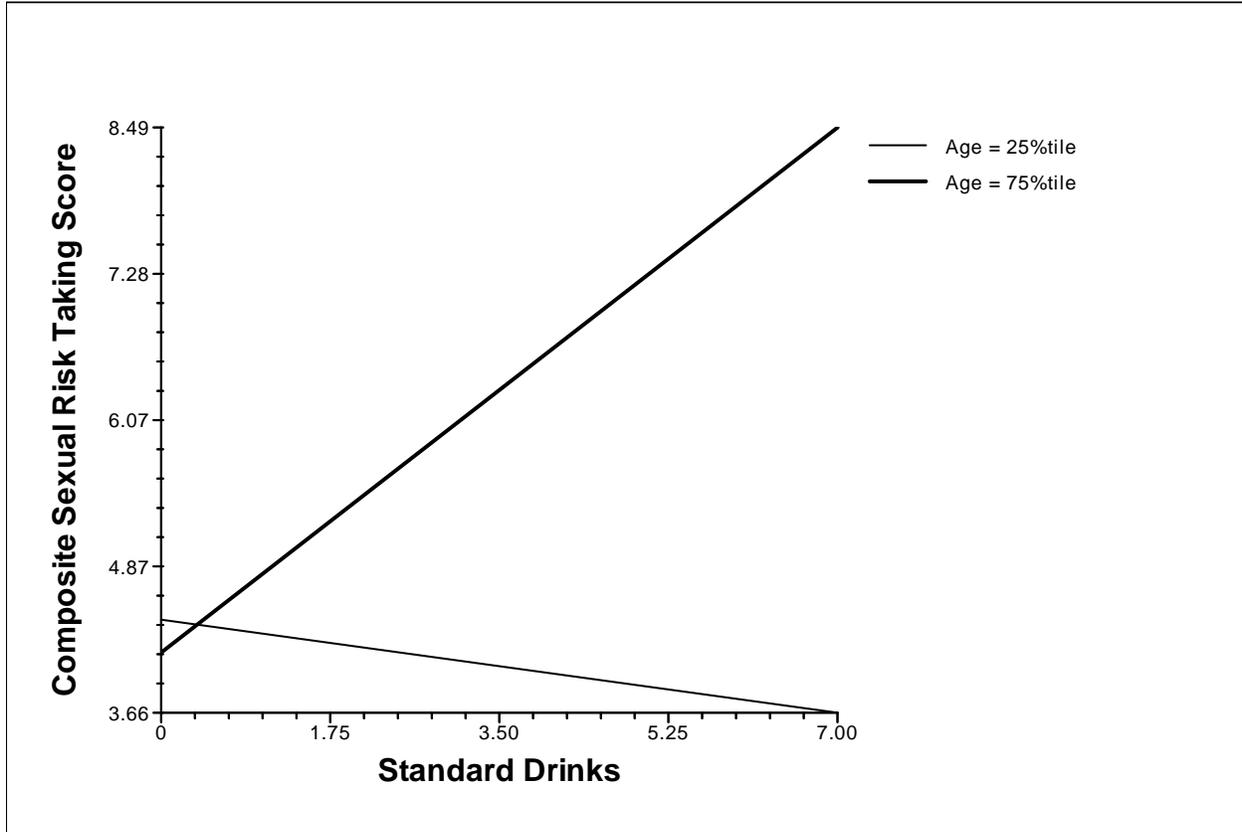
Note: L1= Level 1 of the model (i.e. within-person); L2 = Level 2 of the model (i.e. between-person). L1 Intercept represents the estimate of the mean of the outcome variable holding all other model parameters at zero. L2 main effects are grand mean centered.

Table 3: HLM estimation of effect of alcohol consumption on unprotected anal intercourse with moderation by age.

Effect	Odds Ratio	95% CI	P-value
L1 Intercept	0.36	0.24 - .54	<.001
L1 Main effect of Alcohol	1.01	0.93 – 1.10	.84
L2 Main effect of Age	0.99	0.95 – 1.02	.46
L2 Moderating effect of Age	1.01	1.01 – 1.02	< .05

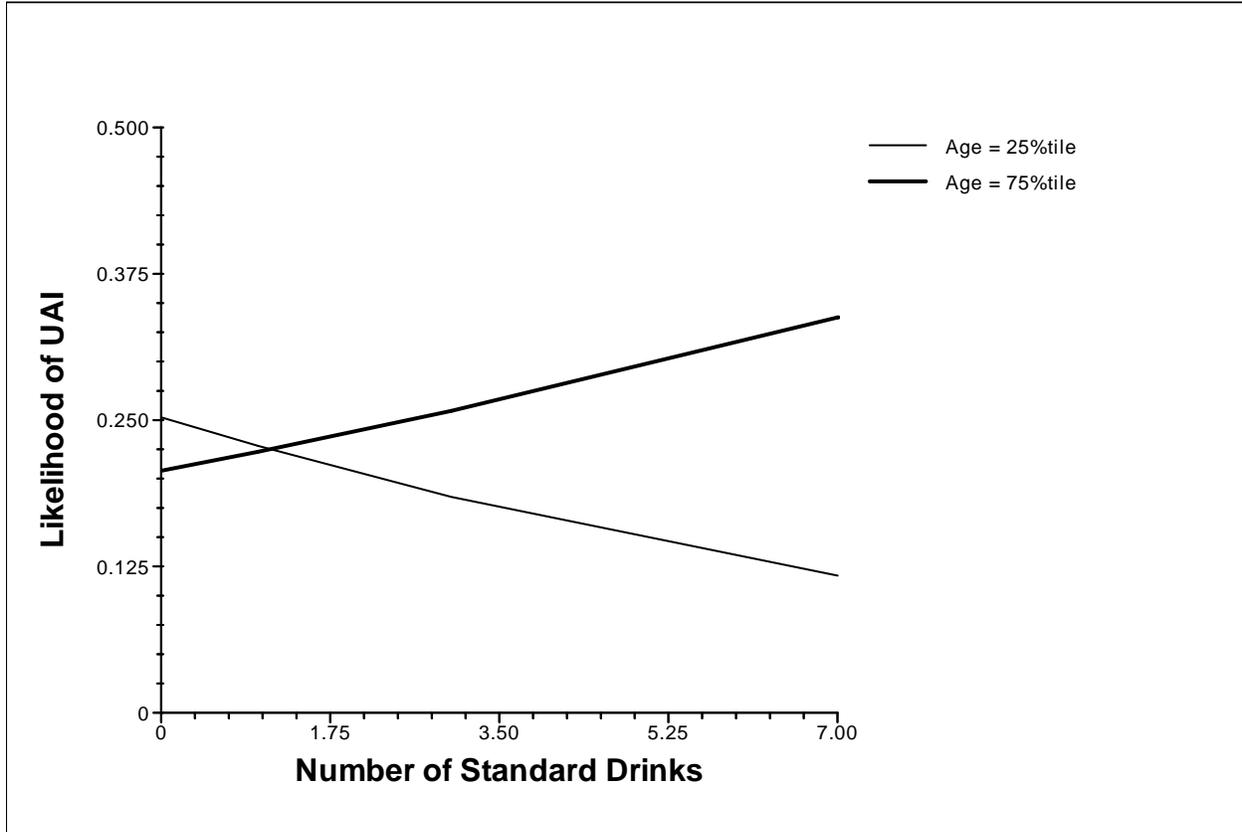
Note: L1= Level 1 of the model (i.e. within-person); L2 = Level 2 of the model (i.e. between-person). L1 Intercept represents the estimate of the mean of the outcome variable holding all other model parameters at zero. L2 main effects are grand mean centered.

Figure 1: Age moderates the association between alcohol consumption and risky sexual behavior.



Note: Main effect of alcohol ($p < .01$) and moderating effect of age ($p < .001$).

Figure 2: Age moderates the association between alcohol consumption and unprotected anal intercourse



Note: Main effect of alcohol ($p = .84$) and moderating effect of Age ($p < .05$).

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