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Daily co-occurrence of alcohol use and high-risk sexual behavior among heterosexual, heavy drinking emergency department patients

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ABSTRACT

Background: Global association and experimental studies suggest that alcohol use may increase sexual behavior that poses risk for exposure to sexually transmitted infections (STI) among heterosexual men and women. However, results from longitudinal and daily recall studies exploring the co-occurrence of alcohol use with various sexual risk outcomes in more naturalistic contexts have been mixed, and the bulk of this research has focused on college students.
Methods: The current study enrolled heavy-drinking emergency department (ED) patients and used a cross-sectional, 30-day Timeline Followback (TLFB) method to examine the daily co-occurrence between alcohol use and three sexual behavior outcomes: Any sex, unprotected intercourse (UI), and UI with casual partners (versus protected intercourse [PI] with casual partners, or UI/PI with steady partners).
Results: Results indicated that increasing levels of alcohol use on a given day increased the odds of engaging in any sexual activity and that heavy drinking (but not very heavy drinking) on a given day was associated with an increased odds of engaging in UI with either steady or casual partners. However, day-level alcohol use was not associated with an increased odds of UI with casual partners.
Conclusions: These findings suggest that alcohol may play an important role in increasing risk for HIV/STIs among heterosexuals, and support the continued need to target heavy drinking in sex risk reduction interventions. However, our results also suggest that alcohol may not universally result in unprotected sex with casual partners, a behavior posing perhaps the highest risk for HIV/STI transmission.

1. Introduction

Unsafe sex (i.e., unprotected sex that could lead to sexually transmitted infections [STI] and/or unintended pregnancies) is a significant cause of disease and disability (Glasier et al., 2006). Indeed, 6.2% of all disability-adjusted life years is attributable to unprotected sexual behavior in the United States (Ebrahim et al., 2005), and the annual direct medical costs associated with STIs topped $15.6 billion dollars in 2008 (Owusu-Edusei et al., 2013). The resurgence of previously well-controlled STIs (e.g., syphilis; Mattei et al., 2012) and growing treatment resistance (CDC, 2013) suggest that the STI-related burden may grow substantially in the near future, highlighting the importance of research into factors contributing to unsafe sex.

Alcohol use has been implicated as a key factor in the spread of STIs (Cook and Clark, 2005; Schneider et al., 2012), due in part to findings from cross-sectional (Grossman and Markowitz, 2005; Sen, 2002) and experimental findings (Rehm et al., 2012) supporting a relationship between alcohol use and unsafe sex. However, design limitations of these studies prevent conclusive inferences about the alcohol-unsafe sex link. Cross-sectional studies focusing on overall involvement in alcohol use and sexual risk (e.g., "over the past 6 months") cannot establish the temporal proximity of the two behaviors. Moreover, experimental studies examine unprotected sex *intentions* using hypothetical scenarios. While there is evidence that intentions to use condoms are a robust predictor of condom use (Albarracin et al., 2001; Reinecke et al., 1996), important differences may exist between intentions rated in laboratory settings and real world behavior.

Situational association studies address these limitations by exploring whether alcohol use co-occurs with unsafe sex on the same occasion in naturalistic contexts. Early meta-analyses of event-level studies found that alcohol appeared to be unrelated to increased unsafe sex (Leigh, 2002; Weinhardt and Carey, 2000),

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but most of these studies explored their co-occurrence on just a few occasions (e.g., first sex, last sex). Studies utilizing more intensive assessments (e.g., cross-sectional daily recall or longitudinal designs) have the potential to explore whether alcohol and unsafe sex co-occur across *many* days, drinking occasions, and sex events over a given time period. Several such studies have been conducted since the aforementioned meta-analyses were published, and suggest that alcohol use consistently increases the likelihood of sex, but that the use of protection may depend on partner factors. For example, one daily diary study (Kiene et al., 2009) and two studies using situation and day-level recall assessments (Brown and Vanable, 2007; LaBrie et al., 2005) showed that drinking increased the odds of unprotected sex specifically with casual partners. However, at least one daily recall study found the opposite. Heavy drinking was associated with unprotected sex only with steady partners, and this relationship was significant only among women (Scott-Sheldon et al., 2010b). Moreover, one daily diary study found that alcohol use was not associated with condom use (Morrison et al., 2003). As such, while situational association studies are critical to understanding whether alcohol use increases unsafe sex in the real world, findings from these studies have been mixed. The vast majority of these studies have also focused on adolescents and college students. Although this may be warranted because of elevated STI risk among young adults (CDC, 2012), few studies have explored the alcohol-unsafe sex link in a broader range of adults or among those who drink heavily. Hence, findings from past studies on this link may be difficult to generalize beyond college students and young adults.

This study addresses this gap in the literature by examining the day-level co-occurrence between alcohol use level and sexual behavior in a sample of heavy-drinking emergency department patients who have engaged in some sexual risk behavior in the past 3 months (i.e., unprotected sex with a casual partner or unprotected sex with a steady partner who's fidelity is questioned or known). We used a cross-sectional daily assessment method (Timeline Followback; TLFB) to explore the association between alcohol use level and three key sex outcomes on a given day: The occurrence of (1) any sex, (2) unprotected intercourse (UI) with either steady or casual partners (versus protected intercourse [PI]), and (3) UI with a casual partner (versus "safer" forms of sex, such as PI with casual partners and/or UI/PI with a steady partner). These three variables allowed us to examine the association of alcohol use with engaging in any sex at all versus sex that is associated with increasing levels of risk. Given our study inclusion criteria, UI with any type of partner conveys some risk. However, because this outcome includes UI with steady partners, the risk for STI transmission may be lower for this outcome, since it may be more likely to involve risk reduction efforts other than condom use (e.g., sexual exclusivity, discussion of sexual history and STI status, use of alternative methods of contraception). UI with casual partners (versus PI with a casual partner or PI/UI with a steady partner), however, likely conveys the highest risk of the three. Based on past findings (e.g., Brown and Vanable, 2007; Kiene et al., 2009; LaBrie et al., 2005; Morrison et al., 2003), we hypothesized that higher levels of alcohol use, specifically use indicative of intoxication (i.e., consuming 5–11, or 12+ drinks on a given day for men, or 4–9, or 10+ drinks for women) would be uniquely associated with an increased odds of engaging in UI with casual partners versus engaging in "safer" forms of sex.

2. Materials and methods

This study used baseline data from 371 patients seeking medical treatment in the ED who enrolled in a randomized trial of a brief, combined intervention for alcohol and sex risk. This broader study explored whether a brief, motivational interviewing intervention could reduce heavy drinking and sexual risk behavior compared with brief advice. Inclusion criteria were: (1) Scores >8 for men and >6 for women on the Alcohol Use Disorders Identification Test (AUDIT; Babor et al., 2001) or >1 episode of binge drinking (5+ drinks for males; 4+ for females) in the past 3 months; and (2) reporting unprotected sex or using alcohol/drugs prior to or during sex during the past 3 months with either a casual partner or a steady partner where infidelity was questioned or known. Patients in a mutually monogamous relationship for >6 months were excluded.

Nine percent of participants reported being bisexual (87.9% women, 12.1% men), 1.6% were gay, 1.6% were lesbian, and 1.1% reported being "not sure" about their sexual orientation. Since factors affecting sexual decision-making among these participants are likely unique (Beyrer et al., 2012; Earl and Albarracín, 2007), we chose to exclude them from the present analyses. Excluding these participants, one transgender participant, and one HIV+ participant resulted in a final sample of 322.

All procedures were approved by university and hospital Institutional Review Boards. Project staff worked on-site in the EDs to identify eligible patients and explain the study. Screening took place with the permission of medical staff and in-between medical care. A mini mental status exam and breathalyzer reading were administered to ensure patients were able to provide informed consent (i.e., the patient was oriented, able to concentrate, and able to understand and remember the requirements of the study).

After informed consent, participants completed most measures using a laptop computer. TLFB measures were collected in interview format to ensure accuracy. Completion of all study measures took 45–60 min.

2.1. Measures

2.1.1. Screening measures. Heavy/problematic alcohol use was assessed using the AUDIT, a 10-item questionnaire (Babor et al., 2001). Scores >8 for males (Conigrave et al., 1995), and >6 for females (Reinert and Allen, 2002) were used as inclusion criteria. *Sexual risk* inclusion criteria were assessed using items on HIV/STI risk from past research (Kalichman et al., 1998; Millstein and Moscicki, 1995), including total number of sex partners, frequency of unprotected sex (vaginal or anal), and frequency of alcohol/drug consumption before or during sex in the past 3 months. *Demographic characteristics* were collected via online questionnaire.

2.1.2. Study measures. Daily alcohol use, drug use, and sexual behaviors were assessed using Timeline Followback (TLFB; Carey et al., 2001; Sobell et al., 1980). Participants reported the number of standard drinks (12 oz. beer, 5 oz. wine, 1.5 oz. of liquor) consumed, and whether marijuana or "other" drugs were used, for each day of the 30 days prior to baseline. Recall accuracy was enhanced by using a calendar and identifying "important dates" for each participant. The TLFB has demonstrated excellent reliability and validity when assessing alcohol and drug use (Fals-Stewart et al., 2000; Sobell and Sobell, 1979, 1980; Sobell et al., 1979).

The TLFB also assessed sexual behavior on each day, collecting information about partner type (regular versus casual) and gender, specific sexual activities performed (vaginal, insertive or receptive anal sex), whether sex took place under the influence of alcohol only, drugs only, or both, and whether a condom was used. TLFBs for sexual behavior have been shown to be reliable and valid (Carey et al., 2001; Napper et al., 2010; Weinhardt et al., 1998; Wray et al., in press). Participants were also asked to indicate whether each sex act occurred with a "regular" partner or "casual" partner. "Regular" partners were defined as someone with whom they were in a "romantic, committed relationship with for at least the past 3 months," and all other partners were coded as "casual." Participants could specify having multiple partners on a given day, and binary indicators were coded for each type of sexual behavior (e.g., unprotected vaginal/anal sex with a casual partner) on a given day.

2.2. Analysis plan

We examined daily associations between static and time-varying variables and the occurrence of three types of sexual behaviors: (1) any vaginal or anal intercourse (insertive or receptive) versus no sex, (2) unprotected vaginal or anal intercourse (UI) versus PI (regardless of partner type), and (3) UI with a casual partner versus PI with a casual partner or UI/PI with a steady partner. Since this final outcome was only relevant for those reporting sex with a casual partner, we restricted this model to these individuals. A four-level, time-varying term was generated to examine the linear effects of alcohol use on a given day and was adjusted for gender. For men: (0) 0 drinks, (1) 1–4 drinks, (2) 5–11 drinks, and (3) 12+ drinks. For women: (0) 0 drinks, (1) 1–3 drinks, (2) 4–9 drinks, and (3) 10+ drinks. These reference groups were chosen to align with NIAAA's definitions of "heavy drinking" (5+ for men, 4+ for women), as these levels pose higher risks for alcohol-related problems (NIAAA, 2005). The heaviest drinking category (12+ for men, 10+ for women) was chosen given evidence that, for men who drink heavily on average (i.e., 5–12 drinks), 12+ drinks on a given day confers additional risk for alcohol-related problems beyond drinking at "binge" (5+ drinks) levels (Greenfield et al., 2014). The value of the very heavy drinking category for women (10+) was derived by extending gender differences in lower drinking categories (4+/5+) to the highest category. We also tested potential quadratic associations between alcohol use on a given day and sex outcomes. Both linear and quadratic alcohol use terms were centered prior to analysis. If the alcohol use term was significant, we ran separate models to test pairwise odds ratios for each drinking category compared to no drinking.

Given that TLFB data produces cross-sectional, time-series data, we used generalized estimating equations (GEEs) in Stata 13 (Stata Corp., 2013) to account for correlations between reports within subjects (Zeger and Liang, 1986; Zeger et al., 1988). Given the binary nature of all outcomes, binomial distributions with logit