



## Short Communication

## Effects of alcohol intoxication and autonomic arousal on delay discounting and risky sex in young adult heterosexual men

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## HIGHLIGHTS

- We tested alcohol and arousal's effects on unprotected sex intentions.
- Explored delay discounting as a mediator of these effects
- Alcohol intoxication increased unprotected sex intentions.
- Subjective sexual arousal, but not autonomic arousal, was associated with risky sex.
- Delay discounting was not related to either alcohol intoxication or risky sex.

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## ABSTRACT

**Objectives:** The relationship between alcohol use and risky sexual behavior is complex and depends on psychological and environmental factors. The alcohol myopia model predicts that, due to alcohol's impact on attention, the behavior of intoxicated individuals will become increasingly directed by salient cues. Autonomic arousal (AA) may have a similar effect on attention. Experiential delay discounting (DD) may be increased by both alcohol consumption and AA due to their common effects and may mediate the relationship between these conditions and risky sex.

**Methods:** This study employed a 3 (alcohol, placebo, control)  $\times$  2 (high, low arousal) experimental design to examine the effects of acute alcohol intoxication and AA on experiential delay discounting, subjective sexual arousal, and risky sex.

**Results:** Path models revealed complex results that only partially supported study hypotheses. Ratings of subjective sexual arousal did not differ across either beverage or arousal conditions. DD was also unrelated to any study variable. However, subjective sexual arousal was positively related to risky sexual intentions. Alcohol intoxication was also positively associated with increased unprotected sex intentions, consistent with past studies.

**Conclusions:** These results affirm the role of subjective sexual arousal and alcohol intoxication in risky sexual decision-making, yielding effect sizes similar to comparable past studies. The lack of differences across autonomic arousal groups also suggests that effects of attentional myopia may be behavior-specific. Failure to replicate effects of alcohol intoxication on DD also suggests reservation regarding its involvement in alcohol-involved risky sex.

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## 1. Introduction

Sexually-transmitted infections (STIs) are a significant health problem among young adults (Owusu-Edusei et al., 2013; Satterwhite et al., 2013). Heavy alcohol use is also common (Wechsler, Lee, Kuo, &

Lee, 2000), and evidence suggests that alcohol intoxication increases unprotected sex (Rehm, Shield, Joharchi, & Shuper, 2012), potentially resulting in STI exposure.

Alcohol myopia theory (AMT) suggests that alcohol limits processing to the most salient information, leading individuals to behave consistent with salient cues (Steele & Josephs, 1990). In sexual situations, cues impelling sex (e.g., arousal, approach motivation) are strong, while inhibitory cues (e.g., disease exposure, social consequences) may be more distal, and alcohol may amplify this balance. Several studies have shown support for AMT's role in risky sex (Davis et al., 2009a;

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**Table 1**  
Descriptive statistics and correlations.

Variables	Range	Mean	SD	Skew	Kurtosis	1	2	3	4	5	6
1. QFV Index <sup>a</sup>	0–1	–	–	–	–						
2. # unprotected sex events (past 3 months) <sup>b</sup>	0–25	2.31	4.91	1.81	4.94	–0.01					
3. Lifetime # sex partners <sup>b</sup>	1–80	10.81	12.65	0.03	2.44	0.11	0.34*				
4. T1 EDT <sup>b</sup>	0–1	0.68	0.18	0.00	3.50	–0.10	–0.16	0.01			
5. T2 EDT <sup>b</sup>	0–1	0.68	0.20	0.00	2.89	0.06	0.03	0.01	0.37*		
6. Subjective sexual arousal <sup>c</sup>	1–8.33	3.72	1.65	0.37	2.29	0.01	0.01	–0.09	0.16	0.14	
7. Unprotected sex intentions <sup>c</sup>	1–9	4.11	2.41	0.59	2.59	0.07	–0.01	0.03	0.15	0.17	0.73*

Note. Skew and kurtosis values are presented for transformed and standardized versions of study variables.

<sup>a</sup> The QFV Index classifies respondents into abstainers, light, moderate, and heavy drinkers. All participants in this study were either moderate or heavy drinkers.

<sup>b</sup> These variables were transformed as a result of non-normality prior to estimating primary analyses, but ranges, means, and standard deviations are presented for these variables untransformed.

<sup>c</sup> Standardized combinations were formed for these items across the two presented scenarios for use in the primary analysis. However, participant means of all items in each category are presented here for ease of interpretation.

\*  $p < .05$ .

George et al., 2009; Norris et al., 2009). Sexual situations also involve autonomic arousal (AA). Attentional myopia theory (Mann & Ward, 2007) suggests that AA produced by exercise may lead to “cue dependence” similar to alcohol (Ward et al., 2008). AA and alcohol may also have synergistic effects on behavior when they are experienced together.

Delay discounting (DD) may be one pathway through which intoxication leads to risky sex. DD refers to decreases in the subjective value of a reward as a function of the delay to its receipt (Bickel, Johnson, Loewenstein, Read, & Baumeister, 2003). DD exhibits relationships with drug use (Kirby & Petry, 2004) and other health risk behaviors (Chapman, 2005). The Experiential Discounting Task (EDT) is thought to be a state-sensitive measure of DD, and one study has shown increased DD among intoxicated individuals on the EDT (Reynolds, Richards, & de Wit, 2006). AA could have similar effects on state-specific measures of DD, given its effects on cognition that are similar to alcohol (Lieberman, 2007; Ward et al., 2008). That is, both intoxicated and aroused individuals may choose immediate rewards as a result of both the narrowed attentional scope and the relative salience of rewards in time.

DD may also serve as a fitting model of sexual risk-taking. Cues suggesting immediate reward (e.g., sexual opportunity) may serve as a strong salient influence on behavior, while longer-term benefits may be inherently more distal. Individual differences in DD are associated with sex risk outcomes (Chesson et al., 2006). Intoxicated individuals opting for more immediate reward despite potential longer-term gains may also opt for immediately gratification in a sexual situation.

We tested whether alcohol intoxication, autonomic arousal, and their interaction increased subjective sexual arousal and unprotected sex intentions in an analogue sexual situation. We also tested whether the effects of intoxication and AA on sex risk intentions were mediated by experiential discounting, above-and-beyond sexual arousal.

## 2. Method

### 2.1. Design

This study employed a 3 (beverage: alcohol [BAC = .08], placebo, or juice control)  $\times$  2 (high [HR = 150 bpm] or low [HR = baseline] autonomic arousal) randomized factorial design. Dependent variables were the EDT, subjective sexual arousal, and ratings of unprotected sexual intentions.

### 2.2. Participants

Participants were 113 undergraduate men, ages 21–32 ( $M = 22.30$ ,  $SD = 1.85$ ). Eighty-seven percent of the sample was White, 6% was Black, 4% Multiracial, 2% Asian, and 1% Native American/Alaskan Native, and 98% was non-Hispanic. Eligible participants were (1) male,

(2) primarily heterosexual, (3) 21 + years old, (4) not currently in an exclusive romantic relationship, (5) sexually active in the last year, (6) not on medications contraindicating alcohol use, and (7) negative for psychiatric or substance use disorders.

### 2.3. Measures

#### 2.3.1. Experiential discounting task

Experiential discounting task (EDT) is a computerized measure of experiential discounting (Reynolds & Schiffbauer, 2004). It involves participants making choices between smaller-sooner (SS) rewards, which are certain and immediate, and larger-later (LL) rewards, which are uncertain and delivered at varying delays (e.g., 0 s, 15 s, 30 s, and 60 s). Choices are delivered in real time via a coin dispenser. Raw EDT indifference values were scored using area under the curve with a trapezoidal rule (Leraas, Patak, Shroff, & Reynolds, 2009; Myerson, Green, & Warusawitharana, 2001). Scores were reversed, with high values representing higher discounting.

#### 2.3.2. Sexual risk scenarios and post-video ratings

Two video scenarios were used to measure risky sexual intentions (Maisto et al., 2004). Each scenario presents a situation in which a male participant is deciding whether to use a condom during sex. After viewing each scenario, participants completed items about subjective sexual arousal and intent to engage in various sexual behaviors. Primary outcomes were intentions to engage in unprotected vaginal sex.

### 2.4. Manipulation checks

Breath alcohol concentration (BrAC) was used to estimate BAC. Single items assessed participants' perceptions of how much they drank and level of intoxication.

### 2.5. Procedure

Participants completed screening measures online, and if eligible, were scheduled for an experimental session and randomized. Upon arrival, research assistants (RAs) verified the participant's age, acquired informed consent, ensured BrACs of .000, collected height, weight, heart rate, systolic (SBP) and diastolic blood pressure (DBP), and fit participants with a continuous heart rate device. RAs then administered the baseline EDT assessment with sessions counterbalanced.

Participants in the alcohol condition received doses to achieve the target BrAC of .08%, according Curtin and Fairchild (2003). Alcohol beverages consisted of a 1:4 ratio of vodka to orange juice. Placebo beverages consisted of orange juice served with a vodka “floater” and vodka-soaked glasses. Beverages were mixed in view of participants. Participants consumed beverages in 15 min, and a 10-minute absorption

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