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Alcohol use and condom use motivation among MSM: an ecological momentary assessment study of motivational processes underlying sexual risk

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ALCOHOL USE AND CONDOM USE MOTIVATION AMONG MSM: AN ECOLOGICAL MOMENTARY ASSESSMENT STUDY OF MOTIVATIONAL PROCESSES UNDERLYING SEXUAL RISK

by

PETER THEODORE LUEHRING-JONES

B.A., Yale University, 2009
M.A., The City College of New York, 2016

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Approved by

First Reader

Tibor P. Palfai, Ph.D.
Professor of Psychological and Brain Sciences

Second Reader

Daniel Fulford, Ph.D.
Associate Professor of Rehabilitation Sciences

Third Reader

Joseph McGuire, Ph.D.
Assistant Professor of Psychological and Brain Sciences

Fourth Reader

Todd Farchione, Ph.D.
Research Associate Professor of Psychological and Brain Sciences

Dedication

This dissertation is dedicated to my family—Mom, Dad, Mark, and Hillary—whose love, support, and encouragement throughout my life have made everything possible.

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PETER THEODORE LUEHRING-JONES

Boston University Graduate School of Arts and Sciences, 2022

Major Professor: Tibor P. Palfai, Ph.D., Professor of Psychological & Brain Sciences

ABSTRACT

Introduction: Alcohol consumption significantly increases the risk of HIV infection among men who have sex with men (MSM). Discounting processes have been proposed as candidate mechanisms of sexual risk, such that the subjective value of a reward (e.g., condom-protected sex) becomes reduced when it can be obtained only after a delay or by expending effort. The present study sought to extend research on discounting as a potential mechanism of alcohol-involved sexual risk among MSM by using a repeated-measures, ecological momentary assessment (EMA) framework in the natural environment to examine within-subjects effects of alcohol consumption on sexual discounting processes.

Methods: Fifty-five binge-drinking MSM completed baseline surveys and then enrolled in a 32-day EMA study period. Each evening, participants completed two of

three discounting tasks: (1) a novel effort discounting task to assess how alcohol affects motivation to expend effort to obtain condoms prior to sex; (2) a condom delay discounting task based on Johnson and Bruner's (2012) sexual delay discounting task; and (3) a novel monetary equivalence task to estimate the monetary value of an episode of condomless anal intercourse (CAI). Participants also reported on alcohol consumption prior to task completion as well as other contextual factors related to sexual risk-taking, including sexual arousal and potential partner attractiveness.

Results: Supporting primary hypotheses, multilevel analyses indicated that within-subjects, alcohol consumption significantly predicted reduced likelihood of expending effort to obtain condoms prior to having sex. Contrary to hypotheses, however, alcohol did not significantly decrease the likelihood that participants would wait to have condom-protected sex, nor did it increase the likelihood that participants would choose to have an episode of CAI over earning money. Secondary analyses revealed (1) significant within-subjects effects of partner attractiveness on both the condom discounting and monetary equivalence tasks, and (2) significant within-subjects effects of alcohol consumption on individual discounting points for the effort discounting task only.

Conclusion: Results suggest that effort discounting may be a viable candidate mechanism for alcohol-influenced sexual risk behavior among MSM. These findings have important implications for intervention development, which may benefit from a focus on increasing motivation to use condoms when drinking.

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List of Abbreviations

ASSIST ..... Alcohol, Smoking, and Substance Involvement Screening Test

AUDIT ..... Alcohol Use Disorders Identification Test

BSCS.....Brief Self-Control Scale

CAI..... Condomless anal intercourse

CPT .....Condom Purchase Task

DMQ-R .....Drinking Motives Questionnaire – Revised

EMA.....Ecological Momentary Assessment

GSAB.....Goal Systems Assessment Battery

HIV .....Human Immunodeficiency Virus

MCAS ..... UCLA Multidimensional Condom Attitudes Scale

MDDQ .....Modified Daily Drinking Questionnaire

MSM ..... Men who Have Sex with Men

NIDA..... National Institute on Drug Abuse

SAES..... Sexual Alcohol Expectancies Scale

SES.....Sexual Expectancies Scale

SIP-2R.....Short Inventory of Problems, Revised

SRS .....Sexual Risk Survey

S-UPPS-P.....

.....Short Urgency, Premeditation, Perseverance, Sensation Seeking, and Positive Urgency Scale

Introduction

Despite numerous advances in prevention efforts for HIV, there were nearly 37,000 newly diagnosed cases of HIV in the United States in 2019, approximately 65% of which occurred among gay and bisexual men (hereafter referred to as men who have sex with men, or MSM) (Centers for Disease Control and Prevention, 2021). Among MSM, condomless anal intercourse (CAI) is the primary vector for HIV transmission (Hojilla et al., 2018; Shuper et al., 2017). With the introduction of pre-exposure prophylaxis, or PrEP, there are now pharmacological approaches that essentially eliminate the possibility of HIV transmission during episodes of CAI (Grant et al., 2010; A. Y. Liu et al., 2016; Molina et al., 2015), but PrEP uptake has been slow among MSM (Sullivan et al., 2018), with studies indicating that only a small proportion of the MSM population of the United States is currently using PrEP to prevent HIV infection (Chan et al., 2021; Dai & Grant Harrington, 2021; Wray et al., 2022). As condoms remain the most common method of HIV and STI prevention (Krishnaratne et al., 2016), reducing the spread of HIV will require a better understanding of the mechanisms that contribute to CAI among this at-risk population (Maisto et al., 2022).

Research into the predictors of condom use over the past several decades has consistently linked alcohol consumption to the incidence of condomless intercourse for MSM and other populations (Berry & Johnson, 2018; Freeman, 2016; George, 2019; Hojilla et al., 2018; Scott-Sheldon et al., 2016; Shuper et al., 2017; E. C. Williams et al., 2016), such that alcohol consumption prior to sex is now recognized as a central risk factor for the transmission of HIV and other STIs (Palfai & Luehring-Jones, 2021; Wray

et al., 2021). Among MSM, alcohol consumption appears to increase the likelihood of risky sexual behavior through disruption of condom use (Rehm et al., 2012; Vosburgh et al., 2012; Wray et al., 2021), with laboratory-based experimental research providing evidence that alcohol increases intentions for CAI and impairs communication about using condoms (Berry & Johnson, 2018; Maisto et al., 2012, 2022; Scott-Sheldon et al., 2016; Wray, Celio, et al., 2019). The mechanisms through which alcohol affects condom use, however, remain only partially understood (Berry & Johnson, 2018; Maisto et al., 2022; Wray et al., 2021).

Increasing knowledge of the mechanisms of alcohol-involved sexual risk among MSM is a matter of critical public health importance, both for expanding theoretical and empirical knowledge about the factors that contribute to sexual risk and for making empirically supported improvements to existing behavioral interventions to reduce that risk (Freeman, 2016; George, 2019; Kazdin, 2007; Scott-Sheldon et al., 2016). Recent reviews of the literature have demonstrated that interventions to reduce the spread of HIV and other STIs among MSM and heterosexual individuals have rarely addressed alcohol use, either as a variable of interest or as a target for direct intervention effects (Palfai & Luehring-Jones, 2021; Scott-Sheldon et al., 2016; Vagenas et al., 2015; Wechsberg et al., 2015; E. C. Williams et al., 2016; Woolf-King et al., 2022; Wray, Grin, et al., 2016). While there have been recent efforts to correct this surprising omission with combined alcohol- and sexual risk-reduction interventions aimed at diverse populations (including MSM, emergency room patients, women with alcohol-use disorders, etc.; e.g., Celio et al., 2017; Dermen & Thomas, 2011; Edelman et al., 2012; Langhorst et al., 2012), more

effective interventions will require greater understanding of the mechanisms that connect alcohol use to risky forms of sexual behavior.

Alcohol Use and HIV Transmission Risk

Associations between alcohol use and HIV transmission among MSM have been studied for the nearly forty years since HIV first emerged in the early 1980s. Since then, questionnaire and daily diary studies have identified global associations between alcohol use and risky sexual behavior; laboratory-based alcohol administration studies have examined how alcohol impacts self-control processes, executive functioning, and cognitive-emotional processes; and ecological momentary assessment (EMA) studies have provided insight into how alcohol affects sexual risk behavior in the natural environment. Findings from these studies, which are discussed in more detail below, have helped to delineate the ways in which alcohol affects sexual decision-making for MSM. Studies among heterosexual individuals have also contributed to knowledge of alcohol-involved sexual risk, such that that between-subjects, alcohol consumption increases intentions to have unprotected sex (MacDonald et al., 1996; Maisto et al., 2012; Shuper et al., 2017), promotes approach biases toward erotic stimuli (Simons et al., 2016), improves appraisals of the sexual potential of potential partners (Norris et al., 2013), impairs safer sex negotiation skills (Gordon et al., 1997; Maisto et al., 2004), reduces consideration of potential negative outcomes (Fromme et al., 1999), and increases positive attitudes toward unprotected sex (Ebel-Lam et al., 2009). While some of this research has been extended to MSM populations, the vast majority of studies of alcohol-involved sexual risk has focused exclusively on heterosexual men and women

(George, 2019; Scott-Sheldon et al., 2016) and it cannot be assumed that results for one population will necessarily hold for another. For example, MSM engage in heavy episodic drinking at higher rates than heterosexual men (Hess et al., 2015), are at greater risk of negative consequences after drinking (Talley et al., 2012), and may consume alcohol for reasons specific to their sexual minority status (e.g., for reasons related to minority stress) (Puckett et al., 2017).

Among MSM, questionnaire and daily diary studies have examined outcomes of alcohol consumption, such as HIV seroconversion, as well as associations between the quantity and frequency of alcohol consumption and increased risk of engaging in unprotected sexual intercourse. Alcohol consumption has been linked to increased risk of HIV seroconversion in several longitudinal studies that followed HIV-negative MSM for years and found significant positive associations between heavy drinking episodes and HIV infection, such that seroconversion rates were almost twice as high for MSM who engaged in regular heavy alcohol use (Chesney et al., 1998; Koblin et al., 2006), though findings were not consistent across other similar studies (Kippax et al., 1998; Ruiz et al., 1998). A more recent meta-analysis (Baliunas et al., 2010), however, confirmed that alcohol consumption is associated with increased risk for HIV infection among men and women who drink (compared to non-drinkers), those who drink before or during sexual encounters, and those who engage in binge-drinking. Given that MSM are more likely to consume alcohol than demographically-matched heterosexual individuals (Hess et al., 2015; Maisto & Simons, 2016), these meta-analytic findings suggest that MSM are likely

to incur greater risk of HIV seroconversion than non-MSM populations due, in part, to their stronger propensity for alcohol.

Alcohol consumption has also been linked to increased risk of CAI among MSM, providing a critical behavioral mechanism for HIV seroconversion. For example, a questionnaire-based study by Colfax et al. (2004) of more than 4,000 MSM found that heavy alcohol use during the six months prior to data collection was significantly associated with serodisconcordant CAI, or having condomless sex with an HIV-positive partner or a partner of unknown HIV status. In addition, heavy alcohol use (defined as the consumption of six or more drinks) before or during sex was also associated with increased risk of serodisconcordant CAI. Significant positive associations between the quantity and frequency of alcohol use and CAI have been observed in other studies (Davidson et al., 1992; Myers et al., 1992; Tawk et al., 2004), with results suggesting that heavy-drinking MSM are almost twice as likely as light and moderate drinkers to have engaged in CAI during the six months prior to data collection (Woody et al., 1999). Heavy alcohol use (compared to lighter use) is also associated with significantly greater risk of condom failure during anal intercourse (Stone et al., 1999). More recent questionnaire and daily diary studies have continued to provide evidence of this association between alcohol use and CAI among MSM. Mustanski (2008), for example, examined daily dairy reports of alcohol consumption and sexual behavior from 143 MSM. Results provided evidence for a causal association between alcohol consumption and increased odds of engaging in risky sexual behavior. Martinez et al. (2017) likewise found a significant relationship between high-risk alcohol consumption and CAI among

Latino MSM during the three months prior to data collection. Several meta-analyses and review papers published over the past ten years have confirmed these important findings (Berry & Johnson, 2018; Heath et al., 2012; Scott-Sheldon et al., 2016)

Laboratory-based alcohol administration studies conducted over the past decade have offered additional insights into the effects of alcohol on sexual decision-making. Maisto et al. (2012) conducted the first laboratory-based alcohol administration study involving MSM and found that alcohol consumption increased sexual risk behaviors by reducing the effectiveness of condom negotiation skills. In a similar alcohol administration study, Wray, Celio, et al. (2019) found that alcohol consumption negatively affected condom negotiations skills; in addition, they also found that alcohol consumption in the laboratory increased intentions to engage in CAI. This finding replicated work by Shuper et al. (2017) that also found a causal link between laboratory-based alcohol consumption and reduced intentions to use condoms during anal intercourse in both HIV-positive and HIV-negative MSM. Recent studies have sought to clarify the cognitive-motivational mechanisms through which alcohol may impact CAI intentions among MSM. Maisto et al. (2022) found that increased intentions for CAI following alcohol consumption was mediated by increases in implicit approach biases to sexual stimuli when sexual arousal was elevated but not when sexual arousal was low. Similarly, links between alcohol consumption and CAI were mediated by impairments in working memory (a component of executive function) only when sexual arousal was low; at higher levels of sexual arousal, no mediation effect was observed. A study by Wray et al. (2021), however, did not find evidence of mediation effects for other components of

executive function (implicit biases and inhibitory control), suggesting that alcohol does not consistently interact with different aspects of hypothesized self-control processes. Together, these findings illustrate the benefits of laboratory-based alcohol administration studies to help elucidate the mechanisms of alcohol-involved sexual risk (Berry & Johnson, 2018; Freeman, 2016; George, 2019) while also highlighting the need for additional research to clarify the role of proposed mechanisms in this relationship.

A final set of studies using EMA has provided additional insight into the association between alcohol and CAI. EMA employs the principle of repeated-measures designs to examine within-subjects mechanisms that underlie the associations between alcohol consumption and risky sexual behavior (Clark & Kim, 2021; Smiley et al., 2020). Fundamentally different from the research approaches described above, EMA methods allow researchers to collect data from study participants as those participants go about their day-to-day lives, outside of the laboratory. This permits the investigation of relationships that would be unfeasible or unethical to model within the laboratory. For example, EMA studies with MSM participants have been used to capture data on psychological states like anxiety and depression, patterns of alcohol and substance use, and engagement in sexual activity with sufficient particularity and temporal proximity to allow the modeling of relationships between affective states, intoxication, and sexual outcomes (Clark & Kim, 2021; Simons et al., 2019). EMA studies allow relationships deduced from global association and laboratory-based alcohol administration studies to be examined in the natural environment, to see whether proposed causal processes are identifiable at the within-subjects level of analysis (Curran & Bauer, 2011). Prompts for

data collection may be set to occur according to a schedule or may be contingent on a particular event, like engaging in sexual activity. EMA data collection has numerous advantages over retrospective self-report measures of data collection, including real-time data recording to minimize recall biases, the inclusion of time as a variable of interest to allow the mapping of complex chronologies of events, and discreet data collection via mobile device (Smiley et al., 2020). Moreover, EMA appears to be acceptable to minority and marginalized populations, making it a valuable tool for data collection on HIV risk behavior among MSM (Duncan et al., 2017, 2019; Sheck et al., 2021; Smiley et al., 2017; Wray, Kahler, et al., 2016)

Thus far, few EMA studies have examined the link between alcohol use and risky sexual behavior among MSM. An EMA study by Maisto et al. (2021) collected EMA data from 236 MSM who submitted multiple daily reports on sexual activity, alcohol consumption, familiarity of sexual partners, and PrEP use. Results indicated that alcohol consumption had a curvilinear association with CAI such that within-subjects, higher than average amounts of alcohol consumption were predictive of episodes of CAI. The authors also found that CAI became more likely for those taking PrEP and those having sex with familiar partners. Similar findings emerged in a study from Wray et al. (2020) in which 100 MSM completed multiple daily EMA surveys on alcohol consumption and sexual behavior. The authors found that when sex occurred, having consumed five or more drinks prior to sex predicted CAI rather than sex with a condom. This relationship was mediated by subjective sexual arousal, suggesting that sexual arousal may be another candidate mechanism for alcohol-involved sexual risk. An earlier study by Wray, Luo, et

al. (2019) used daily EMA surveys to collect information from 80 HIV-negative MSM not taking PrEP. They found significant impacts of contextual factors on sexual risk behavior, including high desire/motivation to have sex, high levels of sexual arousal, and reduced intentions for condom use. Interestingly, alcohol consumption was not related to the incidence of CAI in that study. These and other studies (Maisto et al., 2021; Simons et al., 2019; Wray et al., 2020; Wray, Kahler, et al., 2016; Wray & Monti, 2020) have established the benefits of an EMA approach to modeling sexual risk behavior and confirmed the importance of collecting data on multiple contextual factors (e.g., alcohol use, partner familiarity, sexual arousal, etc.) that have been identified as putative mechanisms of alcohol-involved sexual risk.

As these studies demonstrate, improved knowledge of associations between alcohol use and CAI can be developed through a variety of methods. Questionnaire-based or daily diary approaches, which rely on self-report, can help establish cross-sectional or longitudinal global associations between individual difference variables and behavioral outcomes. Laboratory-based studies can establish the casual impact of alcohol (or other substances) on CAI by manipulating intoxication in a controlled environment (e.g., Maisto et al., 2012), and are useful in identifying between-subjects variables that may make one group of individuals more likely to engage in unsafe sexual behavior when under the influence (Simons et al., 2019). Laboratory studies are limited, however, in that they are often cross-sectional and cannot faithfully or ethically replicate the contexts in which decisions about alcohol use and sexual risk behaviors are made. Examination of within-person associations or processes is a level of analysis often unfeasible in the

laboratory setting, as it usually requires the intensive collection of longitudinal data over a period of time (Bolger & Laurenceau, 2013; T. D. Little, 2013). Intensive longitudinal methods have been long heralded as innovative research approaches but have only recently become practical due to technological advances in EMA data collection like the widespread adoption of smartphones and their associated apps (Chavez & Palfai, 2020; Podsakoff et al., 2019). Within-person study designs allow researchers to focus on causal processes within individuals, to help determine the drivers of specific behaviors at specific moments in time, including contextual factors that contribute to sexual decision-making.

Contextual Factors in Sexual Decision-Making

The research results discussed above provide compelling evidence that alcohol affects sexual decision-making processes among MSM in ways that contribute to the spread of HIV. They also demonstrate that decisions about sexual risk behaviors are made in specific contexts and under the influence of contextual or "visceral" factors (Loewenstein, 1996) that can moderate the association between intended action and actual behavior. For example, research has found that decisions about condom use can be affected by factors like partner attractiveness and sexual arousal that can influence how individuals weigh immediate rewards (such as having an episode of CAI with a more attractive partner) against future rewards (e.g., reducing the likelihood of HIV infection through condom use). Individuals frequently make decisions to engage in behaviors that they acknowledge to be in direct opposition to their better interests because they feel unable to resist temptations offered by visceral factors such that those factors are thought

to be responsible, at least in part, for influencing decisions about engaging in risky sexual behaviors (Ariely & Loewenstein, 2006; Loewenstein, 1996; Maisto et al., 2012)

Studies of MSM and heterosexual individuals have found partner attractiveness to be a risk factor for unprotected sex (Colfax et al., 2004; Eleftheriou et al., 2016; Lambert et al., 2011; Sarno & Mohr, 2020; Shuper & Fisher, 2008; M. L. Williams et al., 2000) by affecting risk perception and increasing intentions to engage in condomless intercourse. Several studies have found associations between greater partner attractiveness and lower perceptions of the risk of STI infection (Agocha & Cooper, 1999; Blanton & Gerrard, 1997; Gold & Skinner, 1992; Schmälzle et al., 2012), though this finding has not been universal, with other studies suggesting that greater attractiveness could be a marker of increased risk (Dijkstra et al., 2000; Gold & Skinner, 1996; Lennon & Kenny, 2013), perhaps due to perceptions that more attractive people may be more promiscuous or have greater opportunities for sexual encounters, thus increasing the likelihood of STI transmission (Dijkstra et al., 2000; Gold & Skinner, 1996). Gold and Skinner (1996), for example, found that among gay men, greater partner attractiveness was associated with greater assumed risk for HIV infection, on the assumption that more attractive gay men had more sex than less attractive gay men. Greater partner attractiveness has also been found to predict greater intentions to engage in condomless sex separate and apart from its effect on risk perceptions (Eleftheriou et al., 2016; Kruse & Fromme, 2005; Lennon & Kenny, 2013; Wongsomboon & Robles, 2017). In a sample of heterosexual and sexual minority men and women, for example, Epstein et al. (2007) found that more attractive

partners were associated with greater intentions to have sex, but not with perceptions of sexual risk.

Research also indicates that higher levels of sexual arousal are linked with greater sexual risk-taking in heterosexual and MSM populations (Ariely & Loewenstein, 2006; Bancroft et al., 2003; George et al., 2009; Shuper & Fisher, 2008; Wray et al., 2015), such that higher levels of sexual arousal have been associated with greater intentions to engage in unprotected sex in both questionnaire and experimental studies (Ariely & Loewenstein, 2006; George et al., 2009; Wolfs et al., 2019). There also appears to be an interaction effect between alcohol use and sexual arousal. In studies of heterosexual individuals (Davis et al., 2007, 2009; Ebel-Lam et al., 2009; George et al., 2009; MacDonald, MacDonald, et al., 2000; Prause et al., 2011; Simons et al., 2016; Wray et al., 2015), participants who were randomized to conditions of increased sexual arousal and alcohol consumption reported greater intentions to forgo condom use than participants who did not consume alcohol. While research among MSM has been more limited, several experimental studies have demonstrated relationships between alcohol use, sexual arousal, and sexual risk-taking. Maisto et al. (2012) found that MSM who consumed alcohol and indicated greater sexual arousal were more likely to express intentions to engage in risky sexual behavior, while Buckheit et al. (2019) found that sexual arousal moderated the effects of perceived intoxication on behavioral skills related to condom use: at low levels of sexual arousal, behavioral skills were enhanced, leading to more effective condom negotiation skills. At higher levels of sexual arousal, however, negotiation skills were impaired. Experimental alcohol administration studies by Wray,

Celio et al. (2019) and Wray et al. (2021) both found significant relationships between increased sexual arousal and intentions to engage in CAI in samples of MSM. More recently, Maisto et al. (2022) found that alcohol consumption in a laboratory setting was indirectly related to greater intentions to engage in CAI via implicit approach biases to sexual stimuli when sexual arousal was high but not when sexual arousal was low; differing levels of sexual arousal also affected the indirect relationship between alcohol use and CAI intentions via impairments in working memory, a component of executive function.

Alcohol Consumption and Motivation for Condom Use

While the studies discussed above have yielded important information about the effects of alcohol and other contextual factors on sexual risk behaviors, one potential mechanism of alcohol-involved sexual risk that remains relatively unexplored is how alcohol consumption affects motivation for condom use. Developing an understanding of how alcohol changes the value of condom use relative to other goals during sexual encounters (e.g., hedonic pleasure, relationship cultivation, etc.) has the potential to inform models of risk and suggest potential avenues for improving behavioral interventions to reduce HIV transmission. Researchers have suggested that insight into motivational processes can be gained by examining how the importance of various goals change as a function of state (within-subjects) and trait (between-subjects) variables (Milyavskaya & Inzlicht, 2018). Discounting processes, which have been used to assess individual differences in preferences for immediate, smaller rewards versus reward that can be obtained only after delay or expending effort (Bickel et al., 2012; Chong et al.,

2016; M. W. Johnson et al., 2021; Rachlin et al., 1991) provide one method for investigating alcohol's impact on motivation for condom use.

Over the last several decades, discounting has been identified as a driver of choice behavior (Holt et al., 2014), including sexual behavior and risky sexual decision-making (Bickel et al., 2012; Bickel & Marsch, 2001; M. W. Johnson et al., 2021). Discounting refers to the general tendency of humans to devalue delayed rewards (Ainslie, 1975; Bickel et al., 2012, 2014; Rachlin et al., 1991; Rachlin, 2006), with differences in discounting rates indicating preferences for short- versus long-term rewards. Exhibiting a preference for an immediate over a delayed reward is one of the hallmarks of impulsive behavior (de Wit, 2008) and so discounting has often been viewed as a behavioral economic measure of impulsivity (MacKillop et al., 2015; Madden et al., 1997), or conversely, of self-control or the extent to which individuals are motivated to wait for a desired outcome (Culbreth et al., 2019; Green et al., 2015; Malesza, 2019; Reddy et al., 2015). Individual differences in discounting rates have been associated with numerous health outcomes, including alcohol and substance abuse, gambling, obesity, and sexual risk behaviors, with greater devaluation of delayed rewards associated with more deleterious health consequences (Bickel et al., 2012). A recent review of sexual discounting has indicated that discounting tasks are "particularly well-suited for modeling temptations and the competing motivations between short- and long-term rewards" (M. W. Johnson et al., 2021, p. 712) and as such are able to capture important information about motivation at the time of task administration.

Variations of discounting include probability discounting, in which the likelihood of rewards are varied instead of time (i.e., "would you prefer to have a 50% chance of receiving $10 or a 30% chance of receiving $20?"), social discounting, where rewards might have to be shared among many or few people, and effort discounting, in which reward values vary along with the amount of effort (physical or mental) required to obtain them (Białaszek et al., 2019). Effort discounting has been a topic of frequent investigation in psychopathology research, where effort discounting tasks have been used to index motivational deficits that are characteristic of several disorders, including schizophrenia and Parkinson's disease (Colón-Semenza et al., 2021; Green et al., 2015; Hartmann-Riemer et al., 2018; Reddy et al., 2015), but researchers have also extended effort discounting research to investigations of motivational processes, such that effort invested in an outcome can be used to infer information about motivation for that outcome (Culbreth et al., 2019; Jurgelis et al., 2021; Massar et al., 2018; Pessiglione et al., 2018; Renz et al., 2022). There is evidence that the level of effort invested in experimental tasks mirrors the level of effort invested in real-life activities (Bickel et al., 2012; Culbreth et al., 2019; Malesza, 2019), suggesting that effort discounting tasks may be useful tools for examining how much effort individuals may be motivated to invest in specific outcomes.

As noted above, sexual discounting tasks have been used to investigate the effect of delay on sexual risk behaviors, including behaviors that increase the likelihood of HIV transmission (M. W. Johnson et al., 2021; M. W. Johnson & Bruner, 2012). The first studies of sexual delay discounting (M. W. Johnson & Bruner, 2012, 2013) found that

cocaine-dependent individuals discounted the value of delayed condom-protected sex compared to immediate sex without a condom. They also found significant differences in discounting rates when participants identified hypothetical potential partners as more attractive and less likely to have an STI, compared to less attractive and more likely to have an STI, so that they were less willing to wait to have sex with a condom when participants were rated in the former two categories. These results have been replicated in studies using identical and similar sexual discounting tasks (e.g., P. S. Johnson et al., 2016), across samples that have included individuals with cocaine use disorder (Jarmolowicz et al., 2015; M. W. Johnson et al., 2015), opioid-dependent women (Herrmann et al., 2014), alcohol-dependent individuals (Jarmolowicz et al., 2013), MSM (Herrmann et al., 2015; Jones, Guest, Sullivan, Kramer, et al., 2018; Jones, Guest, Sullivan, M. Sales, et al., 2018), and college students (Berry et al., 2019; Collado et al., 2017; Lawyer et al., 2010, p. 201; Wongsomboon & Robles, 2017). In all cases, participants discounted delayed sex in a predictable manner described by standard discounting curves. Between-subjects differences have also been observed, such that men discount more steeply than women (Collado et al., 2017, but c.f. Dariotis & Johnson, 2015 who found no significant gender difference in discounting), alcohol and substance-using individuals discount more steeply than non-substance-using controls (Herrmann et al., 2014; Jarmolowicz et al., 2013; M. W. Johnson et al., 2015), and MSM who regularly engage in CAI discount more steeply compared to those who more frequently use condoms during sex (Herrmann et al., 2015; Jones, Guest, Sullivan, M. Sales, et al., 2018). Steeper discounting has also been associated with more sexual sensation seeking

(Lawyer & Schoepflin, 2013) and impulsivity (Herrmann et al., 2014). Even though these studies used several different variations on the original Johnson and Bruner (2012) discounting task, the results present compelling evidence that sexual delay discounting can be considered a proxy measure of HIV and STI risk.

A small number of experimental laboratory-based studies have found that alcohol increases impulsive responding on delay discounting tasks. Reynolds, Richards, and de Wit (2006) administered a computerized Experiential Discounting Task (EDT) to healthy social drinkers at varying levels of intoxication. The EDT is similar to a standard monetary delay discounting task except that it requires participants to actually wait the delay period (usually several seconds to a minute) to collect a larger monetary reward versus immediately collecting a smaller reward (Reynolds et al., 2006). At a high level of alcohol (0.8g/kg), significant alcohol effects were observed on the EDT compared to a lower dose of alcohol (0.4g/kg) and placebo. A replication of this study (Wray et al., 2015), however, did not find significant effects of alcohol on the EDT. In a laboratory study that examined the effects of alcohol on sexual discounting (P. S. Johnson et al., 2016) , participants completed the Sexual Delay Discounting Task (M. W. Johnson & Bruner, 2012) and a novel Sexual Probability Discounting task both when intoxicated in binge-like fashion (1.0g/kg of alcohol administered over a one-hour period) and sober. Results showed that participants were significantly less likely to wait to have condom-protected sex (compared to unprotected sex) when intoxicated and were also significantly less likely to choose to use an immediately available condom at pre-defined levels of risk related to contracting an STI. A cocaine administration study (M. W. Johnson et al.,

2017) found similar results, suggesting that acute cocaine use also affects sexual delay discounting rates. These findings suggest that sexual delay discounting is affected by both between-subject characteristics (i.e., hazardous drug and alcohol use, risky sexual behaviors) and contextual factors like acute alcohol and drug intoxication. Interestingly, acute alcohol consumption does not appear to affect discounting rates in monetary delay discounting tasks (Adams et al., 2017; P. S. Johnson et al., 2016; Reynolds et al., 2006; Wray et al., 2015), though at least one study has shown a significant relationship between increased monetary discounting rates and the likelihood of sexual risk behavior when hazardous drinkers are intoxicated (MacKillop et al., 2015).

Taken together, the results of these observational and experimental sexual delay discounting studies suggest that discounting is a viable candidate mechanism for explaining how alcohol and drug intoxication affect condom use motivation to increase the risk of contracting HIV and other sexually transmitted infections (M. W. Johnson et al., 2021; P. S. Johnson et al., 2016). To-date, no researcher has examined how these processes operate in the natural environment, nor whether they influence decisions about risky sexual behavior in a predictable manner. Results from the present study will help to clarify of the role of discounting as a within-subjects process that may depend on interactive contextual factors like alcohol use, partner attractiveness, sexual arousal, and shifting motivation for condom use.

The Present Study

The present study was designed to assess within-subjects effects of alcohol on sexual discounting tasks to investigate sexual discounting as a potential mechanism of

alcohol-involved sexual risk behavior. As described above, discounting tasks offer a way to quantify how contextual factors like alcohol consumption affect individual differences in preferences for immediate versus delayed rewards and thus provide information about motivational shifts that may occur during alcohol consumption. In previous laboratory studies, alcohol significantly decreased the likelihood that individuals would wait to have condom-protected sex (a delayed reward) when they had the option of having immediate sex without a condom (an immediate temptation) (P. S. Johnson et al., 2016), a result that was replicated with cocaine administration (M. W. Johnson et al., 2017) but only partially with methamphetamine administration (Berry et al., 2022). The purpose of the present study was to expand such investigation to a sample of MSM to examine the effects of alcohol consumption on motivation to use condoms during sexual encounters. In order to identify causal within-subjects associations between alcohol use and motivational changes, the study was designed to use EMA techniques to collect intensive longitudinal data that included daily completion of sexual discounting tasks and a novel monetary equivalence task as well as information on alcohol use, potential partner attractiveness, and sexual arousal.

Aims and Hypotheses

The primary aim of this study was to assess the longitudinal effects of alcohol-induced differences in discounting and monetary equivalence rates related to risky sexual behavior through the use of two sexual discounting tasks and a sexual monetary equivalence task. The first task, an effort discounting task, asked participants to indicate how much effort they would put into obtaining a condom before sex (e.g., “on a scale of

0-100, how likely are you to spend 20 minutes to obtain a condom?"). This novel task was designed to assess changes in motivation to use condoms as a function of increases in the effort required to obtain a condom. The second task, a condom delay discounting task based on Johnson and Bruner's (2012) sexual delay discounting task, measured the relative value of delayed sex with a condom compared to immediate sex without a condom (e.g., "on a scale of 0-100, compared to having immediate unprotected sex, how likely are you to wait one hour to have sex with a condom?"). This task assessed motivation in terms of willingness to wait increasing periods of time to have condom-protected sex. Finally, the novel monetary equivalence task, which asked participants to identify how likely they were to forgo the opportunity to earn increasing amounts of money to have an episode of CAI (e.g., "on a scale of 0-100, how likely are you to forgo the opportunity to earn $50 in order to have an episode of condomless anal intercourse?"), provided a measure of the motivational salience of an episode of CAI by asking participants to express how much money they were willing to give up in order to have sex without a condom. These three measures, which were repeated 21 times each across the 32 days of this study's EMA portion, were used to test the study's primary and secondary hypotheses by capturing within-subjects changes in discounting and monetary equivalence task outcomes caused by alcohol consumption. By using a longitudinal, repeated measures design in EMA format, the tasks were administered to participants during periods of alcohol consumption and periods of sobriety, allowing for within-subjects examination of alcohol-induced changes in motivation for condom use in the natural environment.

The primary hypotheses for this study were as follows:

Hypothesis One: Alcohol intoxication will decrease the effort that individuals will expend to obtain condoms before having sex, compared to periods when participants are sober, across multiple administrations of the effort discounting task.

Hypothesis Two: Alcohol intoxication will decrease the likelihood that individuals will wait longer in order to have sex with a condom across multiple administrations of the condom discounting task, capturing variation in discounting rates due to contextual factors.

Hypothesis Three: Alcohol intoxication will increase the likelihood that participants will choose to forgo the opportunity to make money in order to have an episode of CAI, compared to periods when participants are sober, across multiple administrations of the monetary equivalence task.

The secondary hypotheses of this study were as follows:

Hypothesis Four: For all three tasks, more attractive partners will increase the effects of intoxication on the discounting/monetary equivalence curves derived from the tasks.

Hypothesis Five: For all three tasks, greater sexual arousal will increase the effects of intoxication on the discounting/monetary equivalence curves derived from the tasks.

Methods and Measures

Recruitment

Moderate-to-heavy drinking MSM over the age of 18 were recruited for this study. Recruitment occurred in two stages. During the first stage of recruitment, the study was advertised by email to approximately 100 individuals who had already completed a related study and who had consented to be approached for participation in future studies in our lab. During the second stage of recruitment, advertisements were placed on 88 MSM-focused Facebook group pages organized by MSM around the United States. These Facebook groups had titles like "Gay Men of Massachusetts", "Missouri and Midwest LGBTQ", "Texas Gay Social Group", and "Gay Fellas LA". See Appendix A for the full list of groups targeted by advertising for this study. Advertisements for the study asked interested individuals to send an email to express their interest; once received, emails were sent back to potential participants with a link to complete an online eligibility questionnaire. This eligibility questionnaire included a brief description of the study. If eligible following the questionnaire, potential participants were provided with instructions for enrolling in the study. See Appendix B for email templates used when communicating with potential participants.

Screening

As described above, potential participants were directed to complete an online eligibility questionnaire. That questionnaire was hosted on Qualtrics, an online survey platform. The eligibility questionnaire started with an online-only consent form (see Appendix C) and then asked a series of questionnaires to verify whether potential

participants met the following eligibility requirements: (1) identify as male and have been assigned male sex at birth, (2) be over 18 years old, (3) report a negative or unknown HIV status, (4) be able to read and speak English fluently, (5) report at least one heavy drinking episode (HDE, the consumption of at five or more drinks during a single drinking episode [Wechsler et al., 2002]) during the previous month, (6) report at least one instance of CAI with a man during the past three months, and (7) have access to a smartphone capable of running the Ethica app (the app used for the EMA portion of this study) with an active data plan. Exclusion criteria included (1) being in a sexually exclusive relationship, (2) having a positive HIV diagnosis, (3) currently taking, or having an active prescription for, HIV pre-exposure prophylaxis (PrEP), (4) a lifetime diagnosis of either bipolar disorder or schizophrenia, and (5) current or past-year treatment (counseling or medication) for alcohol or drug use.

A total of 706 potential participants responded to study advertisements and completed the online eligibility questionnaire. See Figure 1 for a CONSORT diagram of participant flow through the study. Of those 706 potential participants, 57 were eligible for the study (8.1%) and 56 enrolled in the study (7.9%). Among the 649 potential participants who were not eligible, 5 were ineligible due to age (0.8%), 36 did not identify as male (5.5%), 205 were in an exclusive, monogamous relationship (31.6%), 41 had a positive HIV diagnosis (6.3%), 114 had not had an episode of CAI during the three months prior to completing the screening questionnaire (17.6%), 74 had not engaged in a HDE during the month prior to screening (11.4%), 231 had an active prescription for PrEP (35.6%), 148 were currently taking PrEP (22.8%), 86 reported a lifetime diagnosis

of bipolar disorder or schizophrenia (13.3%), and 94 reported past-year treatment for alcohol and/or drug use (14.3%). Note that ineligible participants were frequently ineligible for multiple reasons and thus the percentages listed above add to more than 100%. In addition, a number of ineligible participants had implausible patterns of responding to the screening questionnaire (e.g., reporting a disqualifying answer to each of the questions), which suggested that some may have been bots. Indeed, IP addresses of potential participants with "suspicious" patterns of responding often indicated that those responses came from China rather than the United States. Automated bots have become an increasing problem for studies that use online recruiting methods (e.g., Bybee et al., 2021; Godinho et al., 2020; Pozzar et al., 2020), and while various technologies have been developed to reduce the impact of bots on recruitment (e.g., CAPTCHA [Completely Automated Public Turing test to tell Computers and Humans Apart] verifications at the start of surveys, which were utilized in this study), bots remain difficult to eliminate. For this study, however, all participants were contacted by phone or Zoom prior to enrollment (see below), which served to verify that enrolled participants were not bots.

Enrollment

Eligibility results were communicated to all potential participants who completed the online screening questionnaire (see Appendix B for email templates). Eligible participants were invited to schedule a baseline survey session. Each baseline survey session started with a Zoom or telephone call to (1) introduce the participant to the study coordinator, (2) explain the procedures for the baseline session, (3) walk the participant

through the informed consent process, (4) enroll the participant into the EMA portion of the study, with instructions that the EMA portion would start the evening after the completion of the baseline study session, and (5) answer any questions. After starting the phone or Zoom call, the participant was provided with a link to access the online consent form for the study (see Appendix D). The participant was instructed to open the link, review the consent form, and electronically sign the consent form by typing his full name if he wanted to enroll in the study. The study coordinator remained on the call with the participant during this process to answer any questions. After signing, the participant was emailed (1) a copy of his signed consent form, and (2) a link to start the baseline questionnaires. He was also told his participant ID number, which was assigned by the study coordinator while the participant was on the call. The participant was asked to complete the baseline questionnaires on the same day if possible, and most study participants did so. After completion of the baseline questionnaires (see below for more information), the participant was emailed a set of detailed instructions explaining how to enroll in the EMA portion of the study (see Appendix E).

Baseline Questionnaires

Demographics

Standard demographic information was collected from all participants, including age, race, ethnicity, marital status, relationship status, occupation, employment status, annual income in US dollars, highest level of education, current living accommodations, and Kinsey scale response (Kinsey et al., 1948). The Kinsey scale was developed to measure the degree to which respondents consider themselves to be exclusively

heterosexual (one on the Kinsey scale) or exclusively homosexual (six on the Kinsey scale).

Sexual Behavior Questionnaire

The Sexual Behavior Questionnaire (SBQ; Gordon et al., 1997) is an eight item self-report measure of sexual behavior during the 90 days prior to administration. It collects information on number of past male partners (lifetime, past year, and past three months), the estimated frequency of condom use during sexual encounters during the past year, and the number of episodes of condomless anal intercourse, condomless oral intercourse, anal intercourse with condoms, and oral intercourse with condoms during the three months prior to survey administration. The SBQ has been used extensively in studies of MSM as a way to gather data on sexual behavior in this population (e.g., Bustamante et al., 2022; Maisto et al., 2012; Wray, Celio, et al., 2019)

AUDIT

The Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993) is a commonly-used measure of alcohol use, dependence, and consequences. Scores can range from 0 to 40, with scores of 8 or more suggesting drinking that is associated with alcohol-related harm (Conigrave et al., 1995). Research into the psychometric properties of the AUDIT show good validity and reliability across samples that vary by age and ethnic/racial background (de Meneses-Gaya et al., 2009; Reinert & Allen, 2002). Like the SBQ, the AUDIT has also been used extensively in research on MSM (e.g., Santos et al., 2018; Stoloff et al., 2013; Vagenas et al., 2014).

NIDA-MODIFIED ASSIST

The NIDA-modified Alcohol, Smoking, and Substance Involvement Screening Test (NM-ASSIST) (National Institute on Drug Abuse, 2018) is a modified version of the original ASSIST (Humeniuk et al., 2008; WHO ASSIST Working Group, 2002), a screening tool developed by the World Health Organization to identify harmful use of alcohol, tobacco, and other substances. The NM-ASSIST asks about the use of cannabis, cocaine, prescription stimulants, methamphetamine, inhalants, sedatives, hallucinogens, opioids, and "other" drugs, and calculates a substance involvement score that identifies use as either lower risk (scores of 0-3), moderate risk (scores of 4-26), or high risk (scores of 27+). The NM-ASSIST, in either original or modified forms, is a commonly used instrument in research on sexual health and substance use and has been featured in a number of studies of MSM (e.g., Goodman-Meza et al., 2019; Mustanski et al., 2017; Shuper et al., 2018; Storholm et al., 2017)

MDDQ

The modified Daily Drinking Questionnaire (MDDQ; Collins et al., 1985; Dimeff et al., 1999) asks participants to describe a typical week of drinking, including the average number of standard drinks consumed per day as well as the length of time (in hours) during which those drinks are typically consumed. In the United States, a standard drink contains approximately 14 grams of alcohol (Kalinowski & Humphreys, 2016), and is equal to one 12-oz can of beer, one 5-oz glass of wine, or one shot of a higher proof liquor. The MDDQ has demonstrated good reliability and validity among various

populations, including college students and sexual minority women (e.g., Fairlie et al., 2018; Foster et al., 2016; Kazemi et al., 2012).

Drinking Motives Questionnaire – Revised and Sexual Motives for Drinking

The Drinking Motives Questionnaire – Revised (DMQ-R; M. L. Cooper, 1994) is a 20-question measure that assesses reasons for drinking across four subscales: social ("because it makes social gatherings more fun"), coping ("because it helps you when you feel depressed or nervous"), enhancement ("because it's exciting"), and conformity ("to fit in with a group you like"). An additional five questions were added to this measure to assess sexual motives for drinking ("because it helps you enjoy sex more"). High scores on any of the subscales indicate that individuals often credit that motive as the reason for their drinking, regardless of how often they drink (Stewart & Devine, 2000). The DMQ-R has been used extensively in alcohol-related research (e.g., Kuntsche et al., 2005) and has been validated in US and non-US populations (e.g., Martin et al., 2016)

Sexual Alcohol Expectancies Scale

The Sexual Alcohol Expectancies Scale (SAE; Dermen & Cooper, 1994a, 1994b) measures expectancies about the effects of alcohol on sexual experiences in three domains: enhancement ("I feel closer to a sexual partner"), sex risk ("I am less likely to take precautions before having sex"), and disinhibition ("I am more likely to do sexual things that I wouldn't do when sober"). The scale was developed with a large adolescent sample of alcohol-naïve individuals but has been used to evaluate sexual alcohol expectancies in young adults (M. L. Cooper et al., 2016) as well as in samples of adult MSM (Ostrow et al., 2002).

Sexual Sensation Seeking Scale

The Sexual Sensation Seeking Scale (SSSS; Kalichman, 2011; Kalichman et al., 1994) is an 11-item questionnaire measure of sensation seeking, or "the propensity to prefer exciting, optimal, and novel stimulation or arousal" (Kalichman et al., 1994, p. 385) in terms of sexual behavior. The questionnaire was developed on a sample of adult MSM and scores were positively associated with high-risk sexual behavior. The SSSS has been used extensively in research on heterosexual and MSM populations as a way to index tendencies to seek novel and varied sexual encounters, including those linked with risk for HIV infection, like engaging in unprotected intercourse (e.g., Gullette & Lyons, 2005; Kalichman & Rompa, 1995; McCoul & Haslam, 2001).

GSAB for Condom Use

The Goal Systems Assessment Battery for Condom Use (GSAB; Karoly & Ruehlman, 1995) is a 16-item questionnaire of Likert-like scales that yields four subscales of self-regulatory cognitions related to the goal of using condoms during sexual intercourse: value ("this goal is valuable to me"), self-efficacy ("I possess the necessary skills to attain this goal"), monitoring ("I keep track of my progress toward this goal"), and planning ("I try not to let other goals interfere with this goal"). The GSAB was derived from goal-systems/self-regulatory theory and quantifies the extent to which different self-regulatory processes contribute to striving toward goals (Maes & Karoly, 2005). The psychometric properties of the GSAB include good internal consistency and test-retest reliability when used in studies of diverse populations, including among MSM

(Karoly et al., 2005; Karoly & Ruehlman, 1995; Luehring-Jones et al., 2019; Lutz et al., 2008).

Condom Use intentions

Self-regulatory cognitions related to intentions to use condoms during sexual encounters were assessed by four questions similar to those used in past studies of condom use intentions (e.g., Agnew, 1998; Basen-Enquist, 1992; Boldero et al., 1992; Maisto et al., 2012; Sheeran & Taylor, 1999; Tahaney et al., 2019): (1) "Do you intend to use a condom each time you have sex?", (2) "Do you intend to talk to your partner about using a condom each time that you have sex?", (3) Do you intend to insist that you or your partner use a condom each time you have sex?", and (4) Do you intend to resist having sex if your partner refuses to use a condom?". Condom use intentions are frequently assessed in studies of MSM and have been shown to be a reliable predictor of actual condom use (e.g., Andrew et al., 2016; McFarland et al., 2012; Wray, Celio, et al., 2019).

UCLA Multidimensional Condom Attitudes Scale

The pleasure ("condoms ruin the sex act"), identity stigma ("men who suggest using a condom are really boring"), and embarrassment about negotiation and use ("when I suggest using a condom I am almost always embarrassed") subscales from the UCLA Multidimensional Condom Attitudes Scale (MCAS; Helweg-Larsen & Collins, 1994) were administered to study participants. For each statement in each of the three selected subscales, participants used a Likert-like scale to indicate the extent to which they agreed or disagreed with the statement, with higher scores indicating greater agreement. The

MCAS has been used extensively in research involving MSM (e.g., Maisto et al., 2012; Wray, Celio, et al., 2019) and has demonstrated good validity across studies with diverse populations (Starosta et al., 2015; Unger & Molina, 1999).

SIP-2R

The Short Inventory of Problems Revised (SIP-2R; Kiluk et al., 2013) is a 15-item questionnaire measure of common consequences that stem from drinking alcohol (e.g., "I have failed to do what was expected of me because of my drinking", "I have felt guilty or ashamed because of my drinking"). When completing the questionnaire, participants indicate how often each of those consequences has occurred to them after drinking; those responses are then transformed into a score that ranges between 0 and 45, with higher scores indicating a higher incidence of alcohol-related consequences. The SIP-2R and its parent instruments have demonstrated good reliability and validity across diverse populations, albeit with ongoing debate about the most appropriate factor structure of the instrument (Kirouac & Witkiewitz, 2018; Marra et al., 2014; Morse & Robertson, 2017). It has also been used in previous studies of MSM (Anderson et al., 2020; Hagman et al., 2009)

Short UPPS-P

The Short Urgency, Premeditation, Perseverance, Sensation Seeking, and Positive Urgency Scale (S-UPPS-P; Cyders et al., 2014) assess different elements of the construct of urgency, which has been described as the "propensity for mood-based rash action" (Cyders & Smith, 2008, p. 839). For this study, the S-UPPS-P was used to examine the tendency to engage in impulsive behavior in response to strong emotions across five

dimensions: positive urgency ("when I am in a great mood, I tend to get into situations that could cause me problems"), negative urgency ("when I am upset I often act without thinking"), lack of premeditation ("I tend to act without thinking when I am really excited"), lack of perseverance ("I generally like to see things through to the end"), and sensation seeking ("I would enjoy the sensation of skiing very fast down a high mountain slope"). The S-UPPS-P has been used in numerous studies of sexual risk behavior, including among MSM (e.g., Anderson et al., 2020; Maisto et al., 2021).

Brief Self-Control Scale

The Brief Self-Control Scale (BSCS; Tangney et al., 2004) is a 13-item self-report questionnaire of trait self-control. Scores on the BSCS have been correlated with numerous real-world outcomes, like greater academic achievement, a reduced incidence of psychopathology, reduced alcohol abuse, and better interpersonal relationships (de Ridder et al., 2012; Tangney et al., 2004). Since its publication in 2004, the BSCS has been cited in thousands of research papers, including studies that have investigated the role of self-control on sexual behavior (e.g., Rodriguez-Nieto et al., 2019; Skakoon-Sparling & Cramer, 2016) and among MSM (Lehmiller & Ioerger, 2014).

Sexual Risk Survey

The Sexual Risk Survey (SRS; Turchik & Garske, 2009) is a detailed, 23-question measure of sexual activity during the six months prior to administration. It collects information about the type, frequency, and quantity of individual sex acts (e.g., anal sex without a condom, oral sex without a condom), partner type (e.g., anonymous, casual), and other aspects of sexual encounters that may increase the risk of negative health

outcomes (e.g., “how many times have you had sex with a new partner before discussing sexual history, IV drug use, disease status, and other current sexual partners?”, “how many times [that you know of] have you had sex with someone who was also engaging in sex with others during the same time period?”). The SRS yields five subscale scores along different dimensions of sexual risk: sexual risk taking with uncommitted partners, risky sex acts, impulsive sexual behaviors, intent to engage in risky sexual behaviors, and risky anal sex acts. To calculate the subscale scores, participant scores for each item are assigned an ordinal value between 0 and 4 based on the distribution of scores for each item, with 0 being assigned whenever a participant reported no events. For the remaining answers, 1 = 40% of responses, 2 = 30% of responses, 3 = 20% of responses, and 4 = 10% of responses (Lawyer & Mahoney, 2018; Turchik & Garske, 2009). The psychometric properties of the SRS were originally tested and validated in college students (Turchik et al., 2015; Turchik & Garske, 2009), but use of the SRS has expanded to include other populations, including MSM (Arends et al., 2022)

Condom Purchase Task

The Condom Purchase Task (CPT; Strickland et al., 2020) is a newly-developed version of the classic alcohol purchase task (Murphy & MacKillop, 2006) that evaluates behavioral economic demand for condoms across different price points (e.g., $.05 per condom, $2.00 per condom, with a range from $0.00 per condom [i.e., free] to $11.00 per condom) and yields a number of individual difference variables that can be used to assess the degree to which participants value the use of condoms. These indices of demand include derived demand intensity (the quantity of condoms purchased when the price is

zero), derived demand elasticity (how consumption is affected by changes in price), breakpoint (the point at which condoms will no longer be purchased), O_{max} (the maximum expenditure on condoms), and P_{max} (the price at which maximum expenditure occurs). These variables can be determined by fitting CPT responses to the exponentiated demand equation:

$$Q = Q_0 * 10^{k*(e^{(-\alpha*Q_0*C)}-1)}$$

(Koffarnus et al., 2015) where Q = consumption, Q_0 = derived demand intensity, *k* = a constant informed by the consumption range (for the CPT, the *k* value is set to 2, per Strickland et al., 2020), C = commodity price, and α = derived demand elasticity. Output variables were calculated in R version 4.0.5 ("Shake and Throw") (The R Foundation for Statistical Computing, 2021) with package "beezdemand" (Kaplan, 2018; Kaplan et al., 2019).

Daily EMA Surveys

The EMA portion of the study, which started after completion of the baseline surveys listed above, ran for 32 days, with two surveys administered each day: a morning survey and an evening survey. The surveys were administered through the Ethica platform, which includes a research-side website and a participant-side smartphone app. Due to a technical issue, the first 25 participants who enrolled in the study only received the first 31 days of surveys.

The Morning Survey

The morning survey was triggered at 8 am each morning and remained available until 2 pm. Participants were asked to report on their drinking, drug use, and sexual

activity from the previous evening. Questions included objective measures (e.g., "how many standard drinks did you have last night?") and subjective measures (e.g., "how drunk did you get last night?"). Contextual data from sexual encounters included partner type (e.g., male or female; regular, casual, or anonymous) and whether a condom was used. See Appendix F for all questions included in the morning survey.

The Evening Survey

The evening survey was triggered randomly between 7:30 pm and 11:00 pm each evening; this changing trigger time was designed to increase the likelihood that participants would respond to the evening survey in both sober and intoxicated states over the 32-day EMA period. Each evening survey included three components: (1) contextual questions (e.g., "are you drinking right now?", "how horny are you right now?"); (2) questions related to a hypothetical sexual encounter (e.g., "how much would you like to use a condom right now?"); and (3) a combination of two of the following three tasks: (a) the effort discounting task; (b) the condom discounting task; and (c) the monetary equivalence task. For each task, an image of a potential partner preceded the task and participants were asked to provide a subjective rating of his attractiveness to be used in moderation analyses. See Appendix G for all questions included in the evening surveys, including the three tasks described below.

Discounting and Equivalence Tasks

Effort Discounting Task

The novel effort discounting task was designed for this study as a way to infer motivation for condom use by assessing how much effort participants would put into

obtaining a condom prior to having sex with a new male partner. There is a rich literature on tasks designed to quantify effort as a proxy for motivation (e.g., Chong et al., 2016; Massar et al., 2018; Pessiglione et al., 2018), based on effort discounting, or the principle that "a reward carries a higher net value if it is easily obtained than if it is obtained only through great effort" (Botvinick et al., 2009, p. 16). The value of a reward, therefore, can be inferred through the amount of effort a person is willing to expend to obtain the reward, with greater discounting of the reward indicated by a reduced willingness to expend effort. Several paradigms have been developed to assess effort discounting in humans and animals (Chong et al., 2016; Pessiglione et al., 2018); in human studies, such paradigms often ask participants to exert physical or mental effort to access real or hypothetical rewards. For example, a study by Pessiglione et al. (2007) found that participants exerted more physical force through a hand-grip when potential monetary rewards were higher compared to when those rewards were lower, and a study by Treadway et al. (2009) asked participants to choose between easier and harder version of a task in which they could either exert less effort (fewer button pushes) to win a smaller amount of money or exert more effort (more button pushes) to win greater amounts of money. In that study, they found that participants with higher levels of anhedonia (i.e., a lack of interest in pleasurable activities) were less likely to expend effort to obtain greater rewards, a finding consistent with the notion that anhedonia represents a deficit of motivation (J. A. Cooper et al., 2018).

Existing effort discounting tasks have used both real and hypothetical tasks as well as real and hypothetical rewards, with research indicating an equivalency between

the two (Bickel et al., 2009; Lawyer et al., 2011; Locey et al., 2011; Madden et al., 2003, 2004; Malesza, 2019). A real task might be either of the tasks described above, which required participants to exert actual pressure on a hand-grip (Pessiglione et al., 2007) or make rapid button presses on a keyboard (Treadway et al., 2009). Other real effort tasks have involved cognitive efforts, like classification or continuous performance tasks (Kool et al., 2010), or tasks that require participants to shift their spatial attention (Apps et al., 2015). Hypothetical tasks, in contrast, ask participants to imagine that they are expending effort, such as climbing many flights of stairs in a building (Białaszek et al., 2019; Malesza, 2019) or completing other physical tasks (Białaszek et al., 2017). Real rewards are often monetary (Bonnelle et al., 2015; Botvinick et al., 2009; Mitchell, 2004), with participants told that they will receive payment that is proportional to the effort expended during the task. Hypothetical rewards may also be monetary, especially if the amounts are large (Locey et al., 2011; Malesza, 2019), or something else of value to the participant.

In this study, the effort discounting task employed both a hypothetical exertion of effort and a hypothetical reward. During each task administration, participants were first told: “Imagine that you are planning to have sex with a new partner (pictured below). You've chatted with him a few times and like his personality. You believe that sex with him will be fun and enjoyable”. They were then shown an image of the potential male partner and asked to rate how attractive they found him, using a Likert-like scale that ranged from 0 (“not at all”) to 7 (“extremely”). Thereafter, they were provided with the following prompt:

> Imagine that he [the man pictured at the start of the task] is coming over to your home tonight. He will arrive in 2 hours. After cleaning up your room, you realize that you don't have any condoms. You don't know whether he wants to use condoms, whether he has been recently tested for STIs, whether he is on PrEP, or whether he has had sex with multiple recent partners.

The task then asks participants to consider how likely they would be to expend increasing amounts of effort to obtain a condom, with the following instructions:

> Please answer the following questions about how much effort you might expend to get condoms before he comes over. For each question, you'll be asked to indicate on a 0-100 scale how likely you would be to expend the specified amount of effort to get condoms, with 0 meaning that you definitely WOULD NOT expend that amount of effort and 100 meaning that you definitely WOULD expend that amount of effort.

Effort was defined by the amount of time invested in obtaining condoms, starting with a zero-delay trial that asked "how likely are you to spend ANY amount of time to get a condom" and then progressing to five minutes, 10 minutes, 30 minutes, 45 minutes, 60 minutes (one hour), and 120 minutes (two hours). This task was presented 21 times over the course of the 32 days of study enrollment, each time accompanied by the image of a different male sexual partner.

The hypothetical reward offered to participants in the task was the chance to have condoms available during the sexual encounter described in the prompt. Greater likelihood of expending effort to obtain a condom across the time points in the task was hypothesized to indicate greater motivation for condom use.

Condom Discounting Task

The condom discounting task was based on the sexual delay discounting task (SDDT) developed by Johnson and Bruner (2012) and later modified for use with MSM

(Herrmann et al., 2015). In the original Johnson and Bruner (2012) task, which was administered to cocaine-dependent individuals and non-cocaine dependent controls, participants first examined 60 photographs of men and women (30 of each gender) to identify the pictured individuals with whom they would be willing to have casual sex. If participants were in a real-world romantic relationship, they were instructed to think of themselves as single and available for casual sex. From the selected photographs, participants were then asked to determine, based on the photograph alone, which person "(1) [was] most likely to have an STI, (2) [was] least likely to have an STI, (3) he or she most wants to have sex with, and (4) he or she least wants to have sex with" (M. W. Johnson & Bruner, 2012, p. 16). The participants were then asked to answer eight delay discounting questions about each of the four selected people, starting with a zero-delay question that asked participants to indicate the likelihood (on a 0-100 visual analogue scale [VAS]) that they would use an immediately available condom to have sex with the pictured partner. Answers of 0 corresponded to 0% likelihood of using the immediately available condom whereas answers of 100% meant that the participant was certain to use the immediately available condom. The remaining delay discounting questions asked participants to consider the likelihood that they would wait a period of time (in the original task, these times were: one hour, three hours, six hours, one day, one week, one month, and three months) to have sex *with* a condom compared to option of having sex immediately *without* a condom. Responses to the four partner conditions were then used to plot discounting curves and calculate area under the curve (AUC) to allow comparisons between partner conditions. As hypothesized, participants indicated a

greater desire for immediate, unprotected sex with partners judged to be most attractive and least likely to have an STI. A follow-up study provided evidence for strong test-retest reliability for the task (M. W. Johnson & Bruner, 2013). Since then, a number of additional studies have used the SDDT to examine condom-related HIV risk behavior in a number of populations, including heterosexual men and women (Berry et al., 2021; P. S. Johnson et al., 2016; Sweeney et al., 2020), MSM (Herrmann et al., 2015; Jones, Guest, Sullivan, Kramer, et al., 2018; Jones, Guest, Sullivan, M. Sales, et al., 2018), substance-using or -dependent individuals (Berry et al., 2022; Bolin et al., 2016; Herrmann et al., 2014; M. W. Johnson et al., 2015, 2017; Koffarnus et al., 2016; Strickland et al., 2017), and college students (Collado et al., 2017; Wongsomboon & Robles, 2017), with occasional overlap between populations (e.g., Dariotis & Johnson, 2015; Hahn et al., 2019).

In this study, the original Bruner and Johnson (2012) SDDT was modified for use as a daily, repeated-measures task in the following ways. First, given the hypotheses of this study, the original four partner conditions were abandoned and participants completed only one set of discounting questions during each administration of the task. Second, rather than provide each participant with a choice of images illustrating different potential partners, each iteration of the task was accompanied by a single image of a potential partner that had been pre-selected for this study (over the course of the study, participants were provided with photos of male sexual partners that differed on various indices of attractiveness, including age, gender presentation, race, ethnicity, hair color, etc.). The task started with the following prompt: “Imagine that you are planning to have

sex with a new partner (pictured below). You've chatted with him a few times and like his personality. You believe that sex with him will be fun and enjoyable." The photo of the partner was displayed immediately below that text, along with a VAS that prompted the participant to rate the attractiveness of the potential partner from 0 ("not at all") to 7 ("extremely").

Next, participants were presented with the task's zero-delay question:

> Imagine that a condom is immediately available. Using the response scale below, please indicate your likelihood of using that condom when you have sex with this partner, from "I will definitely have sex with this person WITHOUT a condom" to "I will definitely have sex with this person WITH a condom"

and were asked to answer the question using a VAS that went from 0 ("without") to 100 ("with").

The remainder of the questions followed the prompt below:

> For the next set of questions, please imagine that you could have sex with this person immediately WITHOUT a condom, or you could wait a period of time to have sex WITH a condom. For each question, please indicate how likely you would be to wait the specified period of time to have sex with a condom, with 0% meaning that you definitely WOULD NOT wait (i.e., you would have sex without a condom right now), and 100% meaning that you definitely WOULD wait (i.e., you would wait in order to have sex with a condom). Please slide the scale to indicate where your answer would fall between 0% and 100%.

Following the zero-delay question, the remaining delay points in the task were 10 minutes, 20 minutes, one hour, two hours, four hours, 24 hours, three days, and seven days. This task was presented 21 times over the course of the 32 days of study enrollment, each time accompanied by the image of a different potential male sexual partner.

Monetary Equivalence Task

The novel monetary equivalence task was designed to assess motivation for condom use by measuring fluctuations in monetary value assigned to an episode of CAI. During each iteration of the task, participants were asked to indicate on a 0-100% scale the likelihood that they would choose to have an episode of CAI rather than take advantage of an opportunity to earn an increasing amount of money. The prompt for the task specified:

> Imagine that you are facing a choice: you can either (1) complete a short job to earn some money, or (2) have condomless anal intercourse (i.e., bareback sex) with the partner pictured below. For the purposes of this set of questions, imagine that you know there is NO RISK of contracting HIV or any other STIs from this partner.

Participants were told that there would be no risk of contracting HIV or other STIs from the partner to try to capture the value of an episode of CAI without confounds that might be introduced if participants had to consider the risk of negative health consequences from the sexual encounter. As with the effort discounting task and the condom discounting task, each iteration of the task included the image of a different male sexual partner and participants were asked to rate the attractiveness of that partner using a Likert-like scale from 0 (“not at all”) to 7 (“extremely”) prior to answering the monetary equivalence questions.

After rating the attractiveness of the partner, participants were provided with the following instructions:

> For the next set of questions, please indicate how likely you would be to choose to have condomless anal intercourse rather than the short job to earn some money. For each question, you'll be asked to indicate on a 0-

> 100 scale how likely you would be to choose to have condomless anal intercourse, with 0 meaning that you would definitely take the job and 100 meaning that you would definitely have condomless anal intercourse.

Participants used a VAS scale to indicate the likelihood of choosing CAI over the following amounts of money: $1, $10, $25, $50, $75, $100, $250, $500, and $1,000. Like the two discounting tasks, the monetary equivalence task was presented to participants 21 times over the 32 days of the study.

While the monetary equivalence task was designed to follow the format of the two discounting tasks, it was not a discounting task in the usual or traditional sense of asking participants to consider how delay or effort affects the value of a reward (e.g., M. W. Johnson et al., 2021). Instead, it asked participants to indicate their likelihood of choosing between a monetary reward of increasing value and the pleasure gained from an episode of CAI. It was hypothesized that within-subjects, contextual factors like alcohol use, partner attractiveness, and sexual arousal would affect the valuation of CAI across task iterations and thus reveal important information about how those contextual factors might affect motivation to engage in CAI.

Data Analysis

Data orderliness

Data from the three tasks were examined for orderliness based on practices described in previously-published sexual delay discounting papers (Herrmann et al., 2014, 2015; M. W. Johnson et al., 2015; P. S. Johnson et al., 2016; Jones, Guest, Sullivan, M. Sales, et al., 2018; Wongsomboon & Robles, 2017). Per an algorithm developed by M.W. Johnson and Bickel (2008) for assessing delay discounting data,

trials in which there was a 20% or greater increase from one discounting or equivalence point to the next were marked as non-systematic and excluded from subsequent analyses except as described below. This criterion ("criterion one") was designed to identify instances in which participants did not devalue discounted rewards. For example, if a participant were to indicate during the effort discounting task that he would be 20% likely to invest one hour of effort in obtaining a condom but 80% likely to spend two hours doing so (a violation of the criterion), it is likely that he did not understand the task or had entered his answers randomly. Criterion one, however, was not applied to trials in which values for all discounting or equivalence points were less than or equal to 10% likelihood, or during trials in which a greater than 20% increase occurred between two discounting or equivalence points where each was less than or equal to 10% likelihood. In these trials, slight variations (e.g., a 4% likelihood of waiting 10 minutes to use a condom against a 6% likelihood of waiting 20 minutes to use a condom in the condom discounting task) are less meaningful even when there is a greater than 20% increase in the absolute value of the responses between the two adjacent points (Stoltman, 2019). In addition, slight variations in responses within this range may have been due to technical limitations in using the Ethica app: on a standard iPhone or similarly-sized Android phone, the length of the VAS line on which the answers were made (by sliding a slider between 0% at the left end of the line and 100% at the right end of the line) is about 1.5 inches long, which can make it difficult to indicate small differences when entering responses for successive discounting or equivalence points (Stoltman, 2019).

A second criterion ("criterion two") was also applied to the data. Criterion two identified trials in which the value submitted for the final discounting or equivalence point exceeded the first discounting or equivalence point by more than 10%, indicating a lack of systematic responding across the trial. Trials identified as non-systematic per criterion two were also removed from analyses.

Standardized Values in Discounting Tasks

Data from the two discounting tasks were standardized prior to analyses in order to isolate the effect of discounting from individual differences in willingness to expend any effort to acquire a condom (in the effort discounting task) or use an immediately available condom (in the condom discounting task) (e.g., Herrmann et al., 2015; M. W. Johnson et al., 2015; M. W. Johnson & Bruner, 2012; P. S. Johnson et al., 2016; Wongsomboon & Robles, 2017). Standardization was also applied to the monetary equivalence task to adhere as closely as possible to the treatment of the data for the two discounting tasks. To do so, participant responses to the three tasks were divided by the response to the zero-delay question for each trial of the tasks. For the effort discounting task, the zero-delay question was "How likely are you to spend ANY amount of time to get a condom?", while the zero-delay question for the condom discounting task was "Imagine that a condom is immediately available. Using the response scale below please indicate your likelihood of using that condom when you have sex with this partner from 'I will definitely have sex with this person WITHOUT a condom' to "I will definitely have sex with this person WITH a condom'.". The monetary equivalence task did not have a zero-delay value, so the value for the first equivalence point was used. The first

equivalence point asked participants to indicate "How likely are you to choose to have condomless anal intercourse rather than earn $1?".

Capped standardization. When standardization resulted in likelihood values that exceeded one (i.e., when the likelihood value for the zero-delay question was lower than responses to questions with longer delays), standardized values were capped at one by assigning them a value of one (M. W. Johnson et al., 2015; P. S. Johnson et al., 2016).

Zero Trials

For all three tasks, there were participants who indicated a zero percent likelihood of expending effort to obtain a condom, having sex with an immediately available condom, or have having episode CAI rather than earn money at the first discounting or equivalence point (zero trials). Standardization could not be applied to these trials because doing so would involve dividing all subsequent discounting/equivalence points by zero, resulting in undefined values. Per past practice (Herrmann et al., 2014, 2015; M. W. Johnson et al., 2015; M. W. Johnson & Bruner, 2012; Koffarnus et al., 2016; Wongsomboon & Robles, 2017), these zero trials were removed from subsequent analyses using standardized data. They were retained, however, for the point-by-point analyses described below.

Calculating Area Under/Over the Curve

Following standardization, area under the curve (AUC) was calculated for each trial of the three tasks to serve as the outcome variable for the tasks. To do so, the method proposed by Myerson, Green, and Warusawitharna (2001) was used. AUC was calculated as the sum of successive trapezoids formed by the likelihood values of each

discounting/equivalence point, a method that has been identified as "theoretically neutral" (Wongsomboon & Robles, 2017, p. 2135) because it measures discounting using the actual data returned by participants rather than fitting those data to mathematical discounting models that provide a derived value for the steepness of the discounting curve (Jarmolowicz et al., 2015; Lawyer et al., 2010; Myerson et al., 2001; Wongsomboon & Robles, 2017).

For convenience purposes, AUC data for the effort and condom discounting tasks were converted to area over the curve (AOC) prior to analyses. This was done by calculating the total possible AUC for each task and then subtracting the actual AUC from that value. In both the effort and condom discounting tasks, higher AUC was associated with greater likelihood of exerting effort to obtain a condom prior to sex and greater likelihood of waiting to have condom-protected sex, respectively—or, in other words, with greater likelihood of engaging in behaviors that would be protective of sexual health. Since this study was concerned with examining the potentially deleterious effects of alcohol use, partner attractiveness, and sexual arousal on motivation to use condoms, it was conceptually easier to convert AUC into a variable that was positively rather than negatively associated with sexual risk behaviors. Since AOC is the converse of AUC, AOC provided a value that increased when participants indicated they were less likely to expend effort to obtain a condom prior to sex or wait to have condom-protected sex. In other words, while higher AUC was associated with health-protective behaviors, higher AOC was associated with sexual risk behaviors.

AUC data from the monetary equivalence task were not converted to AOC because AUC was already positively associated with a greater likelihood of choosing to have CAI rather than earn a quantity of money. Higher AUC for the monetary equivalence task therefore indicated a greater preference for CAI while lower AUC indicated a greater preference to earn money.

Results

Baseline Questionnaires

Demographics

As noted above, 56 participants enrolled in the study and 55 completed the baseline questionnaires. Those 55 participants had an average age of 32.6 years (SD = 9.0 years) and reported an average annual income of $41,940 (SD = $30,626). Reported race was 70.9% white (n = 39), 10.9% Black or African American (n = 6), 12.7% other (n = 7), 3.6% Asian (n = 2), and 1.8% unreported (n = 1). 18.2% (n = 10) of the sample identified as Hispanic or Latino. Most participants (72.7%, n = 40) were not in a relationship while enrolled in the study, while 27.3% (n = 15) were in a relationship. Of participants in relationships, 73.3% (n = 11) were in a relationship with one other man and 26.6% (n = 4) were in relationships with more than one man. No participant reported being in a relationship with a woman. Nearly three-quarters of the participants (74.5%, n = 41) identified their sexual orientation as homosexual only (Kinsey six), while the remaining participants (25.5%, n = 14) indicated some degree of preference for both male and female sexual partners (Kinsey three, four, and five). See Table 1 for complete demographic information.

Sexual Behavior Questionnaire

The number of lifetime male sexual partners reported by the participants was positively skewed and ranged from two to 1200, with a mean of 126 partners (SD = 263 partners), median of 40 partners, and an interquartile range from 17 partners to 89 partners. The number of past-year sexual partners ranged from one to 750, with a mean

of 26 partners (SD = 105 partners), a median of four partners, and an interquartile range from two partners to eight partners. Finally, the number of past three-month sexual partners ranged from one to 40, with a mean of three partners (SD = five partners), a median of two partners, and an interquartile range from one partner to three partners. Participants reported infrequent condom use during the three months prior to enrollment in the study, with a mean of 2.18 ("rarely", SD = 1.17) on a Likert-like scale that ranged from 1 ("never") to 5 ("always"). The modal incidence of CAI during the three months prior to the study was one, with a mean of 5.74 CAI events (SD = 8.01 events) and a median of three events.

AUDIT

The mean AUDIT score was 11.44 (SD = 4.85), with a minimum score of 3 and a maximum score of 27. Forty-four participants (80.0%) returned scores of 8 or greater on the AUDIT, indicating harmful or hazardous drinking.

NIDA-modified ASSIST

Except for cannabis, the modal number of users of each class of substances on the NIDA-modified ASSIST was zero. Cannabis was the most frequently used substance, with 39 participants reporting use in the three-month period prior to the study. At least one participant reported prior three-month use of substances in all categories except for street opioids (e.g., heroin, opium), but some participants did report lifetime use in that category. Lower risk use (scores of 0-3) was the most common type of use across all substance categories, with some participants scoring in the moderate risk category (scores

of 4-26). There was no high-risk use (scores of 27+) reported by any participant in any category of substance.

Modified Daily Drinking Questionnaire

Participants reported consuming an average of 20.9 standard drinks (SD = 16.9 standard drinks) per week. Approximately half of that drinking occurred during the weekend, on Friday and Saturday, with an average of 10.8 standard drinks (SD = 8.6) consumed over the course of those two days. Binge-drinking (e.g., among men, the consumption of five or more drinks of alcohol within a single drinking episode [Wechsler et al., 2002]) was common in the sample, with only six participants (10.9%) reporting that they had not had a single binge-drinking episode during the three months prior to the study. Binge-drinking "once or twice a week" was the most commonly-endorsed frequency of binge-drinking (34.5%, n = 19), while other participants reported binge-drinking "more than once a day" (3.6%, n = 2), "nearly every day" (3.6%, n = 2), "3-4 times per week" (9.1%, n = 5), "once a month" (18.2%, n = 10), and "less than once a month, but at least once in the last 90 days" (20.0%, n = 11).

Drinking Motives Questionnaire – Revised and Sexual Motives for Drinking

Participants indicated the frequency with which each item on the DMQ-R was related to their motives for drinking using a five-point Likert-like scale, from 1 ("almost never/never") to 5 ("almost always"). Social motives were the most-frequently endorsed motives for drinking, with a mean score of 3.57 (SD = 0.98), followed by enhancement motives (mean = 2.99, SD = 0.90), coping motives (mean = 2.34, SD = 0.81), sexual motives (mean = 2.14, SD = 0.95), and conformity motives (mean = 1.74, SD = 0.77).

Reliability of the subscale scores was generally moderate to high, with Cronbach's alphas of .844 for the social motives subscale, .806 for the enhancement motives subscale, .744 for the coping motives subscale, .893 for the sexual motives subscale, and .789 for the conformity motives subscale.

Sexual Alcohol Expectancies Scale

Participants reported an average score of 21.81 (SD = 7.57) on the SAE. All participants reported at least some sexual alcohol expectancies (minimum score = 2.00). The highest participant score was 36.00 (out of a possible of maximum score of 39.00). Reliability of the scale was high, with a Cronbach's alpha of .859 across the 13 items of the scale.

Sexual Sensation Seeking Scale

Participant responses on the SSSS ranged from 18.00 to 44.00, with an average score of 31.53 (SD = 5.01). Reliability of the scale was moderate, with a Cronbach's alpha of .710 across the 11 items of the scale.

GSAB for Condom Use

Participants indicated the extent to which they felt the 16 items of the GSAB for condom use were true, using a five-point Likert-like scale, from 0 ("not at all") to 4 ("extremely accurate"). The highest subscale score was for condom-use self-efficacy, with a mean rating of 2.90 out of 4.00 (SD = 1.03), followed by subscale scores for condom-use value (mean = 2.31, SD = 1.13), condom-use planning (mean = 1.68, SD = 1.20), and condom-use monitoring (mean = 1.67, SD = 1.11). Reliability of the subscale

scores was high, with Cronbach's alphas of .920 for the self-efficacy subscale, .939 for the value subscale, .910 for the planning subscale, and .831 for the monitoring subscale.

Condom Use Intentions

For the four intentions questions, participants indicated the extent to which they intended to perform different actions (e.g., "do you intend to insist that you or your partner use a condom each time you have sex?") with a five-point Likert-like scale, from 0 ("no") to 4 ("definitely"). Reliability for the intention subscale was high, Cronbach's alpha = .921. The mean intention subscale score was 1.87 (SD = 1.25; between "maybe" and "probably"), indicating generally low intentions to use condoms during sex.

UCLA Multidimensional Condom Attitudes Scale

Participants completed questionnaire items from three of the MCAS subscales: pleasure, identity stigma, and embarrassment about negotiation and use. For items that referred to women (e.g., "women who think men who use condoms are jerks"), the word "woman" or "women" was replaced by "man" or "men" to accord with the sexual orientation of the participants. For one question ("if a couple is about to have sex and the man suggests using a condom, it is less likely that they will have sex"), the phrase "the man" was replaced with "one partner" to avoid inappropriately insinuating that only one partner is the "man" during sexual acts between MSM. For each item, participants indicated their agreement or disagreement with the statement using a seven-point Likert-like scale, from 1 ("strongly disagree") to 7 ("strongly agree").

The mean pleasure subscale score was 3.30 (SD = 1.23, between "slightly disagree" and "neither"), indicating participants either slightly disagreed or felt neutral

about the idea that condoms can increase pleasure during sex. Reliability for the subscale was moderate, Cronbach's alpha = .788.

The mean identity stigma subscale score was 5.76 (SD = 0.88; between "slightly agree" and "agree"), suggesting more positive attitudes toward men who suggested condom use. Reliability for the subscale was moderate, Cronbach's alpha = .607.

The mean embarrassment and negotiation about use subscale was 5.32 (SD = 1.10, between "slightly agree" and "agree"), indicating that participants did not feel embarrassed about negotiation or use of condoms during sex. Reliability for the subscale was moderate, Cronbach's alpha = .766.

SIP-2R

The SIP-2R asks participants to describe the incidence of alcohol-related consequences over the three months prior to questionnaire administration and returns of a score between 0 (no consequences) and 45 (experiencing each of the 15 listed consequences "daily or almost daily"). The mean SIP-2R score in this sample was 8.56 (SD = 5.62), with a minimum score of 1, a maximum score of 27, and an interquartile range from 5 to 11. The modal score was 10. Reliability of the scale was high, with a Cronbach's alpha of .836 across the 15 items in the scale.

Short UPPS-P

The Short UPPS-P asks participants to respond to 20 items on a four-point Likert-like scale, from 1 ("agree strongly") to 4 ("disagree strongly"). Each of the five subscales (negative urgency, positive urgency, sensation seeking, lack of perseverance, and lack of premeditation) is formed by average responses across four of the items. One

item, a question that forms part of the negative urgency subscale ("Sometimes when I feel bad, I can't seem to stop what I am doing even though it makes me feel worse"), was inadvertently omitted from the online baseline questionnaires, and so the negative urgency subscale was formed using only three items. For all subscales, higher scores were coded to indicate greater impulsivity, per Cyders et al. (2014).

The mean negative urgency subscale score was 2.13 (SD = 0.65) out of a maximum score of 4.00. Reliability for the subscale was moderate, Cronbach's alpha = .641.

The mean positive urgency subscale score was 1.98 (SD = 0.58) out of a maximum score of 4.00. Reliability for the subscale was moderate, Cronbach's alpha = .599.

The mean sensation seeking subscale score was 2.78 (SD = 0.68) out of a maximum score of 4.00. Reliability for the subscale was moderate, Cronbach's alpha = .603.

The mean lack of perseverance subscale score was 1.67 (SD = 0.48) out of a maximum score of 4.00. Reliability for the subscale was moderate, Cronbach's alpha = .648.

The mean lack of premeditation subscale score was 1.60 (SD = 0.52) out of a maximum score of 4.00. Reliability for the subscale was high, Cronbach's alpha = .816.

Brief Self-Control Scale

The BSCS asks participant to indicate how much each of 13 items "reflects how you typically are" using a five-point Likert-like scale, from 1 ("not at all") to 5 ("very

much"), with higher scores reflecting more self-control. When originally published, the scale was described as a unidimensional construct measuring trait self-control (Tangney et al., 2004); since then, other authors have suggested that the BSCS is better described as multifactorial, though there is disagreement over the number of factors and the meaning of those factors (de Ridder et al., 2011; Lawyer & Mahoney, 2018). In addition to calculating a total scale score (i.e., the BSCS as a unidimensional construct), de Ridder et al.'s (2011) subscale scores of inhibitory and initiatory self-control were also calculated.

When considered as a single dimension of self-control, the measure yielded a mean scale score of 3.10 (SD = 0.55) with moderate reliability, Cronbach's alpha = .748. The inhibitory sub-scale had a mean of 3.00 (SD = 0.57) with moderate reliability, Cronbach's alpha = .555, while the initiatory sub-scale had a mean of 3.40 (SD = 0.70) with low reliability, Cronbach's alpha = .495.

Sexual Risk Survey

As noted above, the SRS returns quantitative information about the frequency of risky sexual acts in the six months prior to survey administration. In addition, scores for five subscales can be calculated, with increasing scores in each subscale indicating higher levels of sexual risk. Those subscales are risky sex acts, risky anal sex acts, intent to engage in risky sexual behaviors, impulsive sexual behaviors, and sexual risk taking with uncommitted partners.

The mean total scale SRS score was 24.38 (SD = 12.12) out of a maximum of 92.00. Within the sample, the minimum score was 4.00, the maximum score was 55.00,

with an interquartile range was from 15.00 to 35.00. Reliability of the total scale score was high, Cronbach's alpha = .874.

The mean subscale score for the sexual risk with uncommitted partners was 9.93 (SD = 6.09). Reliability of the subscale was high, Cronbach's alpha = .835.

The mean subscale score for the risky sex acts subscale was 4.17 (SD = 2.52). Reliability of the subscale was moderate, Cronbach's alpha = .561. Three of the five subscale items asked participants about sex acts with female partners (e.g., incidence of (1) vaginal sex without a condom, (2) vaginal sex without birth control, and (3) cunnilingus without protection), all of which occurred infrequently in the sample. The relatively low frequency of these sexual acts may have contributed to the moderate reliability of this subscale.

The mean subscale score for the impulsive sexual behaviors subscale was 5.21 (SD = 3.78). Reliability of the subscale was moderate, Cronbach's alpha = .749.

The mean subscale score for the intent to engage in risky sexual behaviors subscale was 1.56 (SD = 2.13). Reliability of the subscale was high, Cronbach's alpha = .838.

The mean subscale score for the risky anal sex acts subscale was 3.83 (SD = 2.31). Reliability of the subscale was moderate, Cronbach's alpha = .623.

Condom Purchase Task

Demand intensity. Within the sample, mean observed demand intensity (e.g., the number of condoms purchased when the price is zero) was 38.46 condoms (SD = 35.54

condoms) while mean derived demand intensity (Q_0) was 40.01 condoms (SD = 37.20 condoms).

Demand elasticity. The mean derived demand elasticity (α) was .011 (SD = .019).

Maximum expenditure. Within the sample, mean empirical maximum expenditure ($O_{max\ –\ observed}$) was $37.62 (SD = $50.51) while mean derived maximum expenditure ($O_{max\ –\ derived}$) was $28.74 (SD = $41.69).

Price at maximum expenditure. The mean observed price at maximum expenditure ($P_{max\ –\ observed}$) was $5.57 (SD = $4.38) while the mean derived price at maximum expenditure ($P_{max\ –\ derived}$) was $3.87 (SD = $4.49).

Breakpoint. The mean breakpoint (e.g., the price point after which condoms will no longer be purchased) was $5.33 per condom.

Effort Discounting Task

A total of 851 trials of data were generated for the effort discounting task. Of these, two trials were removed for having missing data. Of the remaining 849 trials, 637 were systematic, with 70 trials nonsystematic for criterion one, 5 trials nonsystematic for criterion two, and 137 trials nonsystematic for being zero trials. Participants completed an average of 12.5 systematic trials, 0.7 nonsystematic trials (per criteria one and two), and 2.7 zero trials for this task. Two participants were removed from primary and secondary analyses because they had zero standardized, systematic trials available for analyses. Both of those participants were included in the point-by-point analyses, however. See Figure 1 for mean task responses.

Condom Discounting Task

The condom discounting task generated 892 trials of data. Five trials were removed for having missing data. Of the remaining 887 complete trials, 539 were systematic, with 224 trials nonsystematic for criterion one, 5 trials nonsystematic for criterion two, and 119 trials nonsystematic for being zero trials. Participants completed an average of 10.6 systematic trials, 2.2 nonsystematic trials (per criteria one and two), and 2.3 zero trials for this task. Five participants were removed from primary and secondary analyses because they had zero standardized, systematic trials available for analyses. Four of those participants were included in the point-by-point analyses, with one excluded from both sets of analyses because he had zero standardized, systematic trials and no zero trials. See Figure 2 for mean task responses.

Monetary Equivalence Task

The monetary equivalence task generated 831 trials. One trial was removed for having missing data. Of the remaining 830 trials, 534 were systematic, with 82 trials nonsystematic for criterion one, 6 trials nonsystematic for criterion two, and 209 trials nonsystematic for being zero trials. Participants completed an average of 10.5 systematic trials, 0.9 nonsystematic trials (per criteria one and two), and 4.2 zero trials for this task. Four participants were removed from primary and secondary analyses because they had zero standardized, systematic trials available for analyses. All four of those participants were included in the point-by-point analyses, however. See Figure 3 for mean task responses.

Excluded Participants

Of the 55 participants who completed the baseline questionnaires, four responded to fewer than 33% of the EMA surveys[1] and are not included in the analyses that follow due to an *a priori* decision to exclude data from participants who completed fewer than 33% of the EMA surveys. Those four excluded participants differed slightly from the included participants along the following dimensions only: they were older (average of 41.5 years versus 31.86 years), $t(53) = 2.256$, $p = .028$; they had greater scores on the DMQ-R enhancement, social, and coping subscales (mean scores of 4.35 versus 2.89, $t(53) = 3.422$, $p < .001$; 4.35 versus 3.51, $t(9.851) = 4.136$, $p = .002$; and 3.10 versus 2.28, $t(53) = 2.005$, $p = .050$, respectively); and they reported no use of inhalants on the ASSIST (mean inhalant subscale risk score of 0 versus 2.25, $t(50) = -4.721$, $p < .001$). The group differences seen here may be due to random variation or may be associated with the significantly older ages of the excluded participants. The four excluded participants were white and did not identify themselves as Hispanic or Latino.

Correlational Analyses

As described above, all three of the daily survey tasks—the effort discounting task, condom discounting task, and monetary equivalence tasks—were hypothesized to measure sexual risk. To examine this hypothesis, a set of correlational analyses were conducted to examine relationships between task output and other measures of sexual risk that were included in the baseline questionnaires. For each participant, AOC/AUC

[1] Of those four participants, two did not completed any EMA surveys, one completed one evening survey, and one completed eight morning surveys.

calculated from standardized systematic trials were averaged to create a single output score to represent performance on each task across the entirety of the EMA survey period. These output scores were then correlated with measures in the following areas: (1) sexual behavior (with data from the SBQ, including counts of lifetime, past year, and past 3-month sexual partners; the past 3-month incidence of CAI, and the frequency of condom use[2], see Table 2); (2) self-regulatory cognitions related to condom use (the GSAB subscales of condom use value, self-efficacy, monitoring, and planning; the condom use intentions scale; and the MCAS pleasure, identity stigma, and embarrassment about negotiation and use subscales, see Table 3); (3) urgency and self-control (the positive urgency, negative urgency, sensation seeking, lack of perseverance, and lack of premeditation subscales from the S-UPPS-P; and total BSCS, inhibitory self-control, and initiatory self-control scores, see Table 4); (4) risky sexual acts (the SRS risky sex acts, risky anal sex acts, intent to engage in risky sexual behaviors, impulsive sexual behaviors, and sexual risk taking with uncommitted partners subscales, see Table 5); and (5) behavioral economics of condom use (the observed and derived outcomes from the Condom Purchase Task, see Table 6).

Effort Discounting Task.

Sexual behavior (see Table 2). Mean effort discounting task scores were significantly negatively correlated with the frequency of past-year condom use ($r = -.411$, $p = .003$), and were non-significantly associated with greater lifetime male sexual

[2]Significant outliers (greater than three standard deviations from the mean) were present in the count data from the SBQ. To address the potential impact of these outliers, values greater than three standard deviations above the mean were substituted with the value of the case that was closest to but less than three standard deviations above the mean, per Tabachnick & Fidell (2013).

partners (r = .177, p = .255), past-year male sexual partners (r = .163, p = .269), past three-month male sexual partners (r = .162, p = .267), and past three-month incidence of CAI (r = .160, p = .278).

Self-regulatory cognitions related to condom use (see Table 3). Mean effort discounting task scores were significantly negatively correlated with the GSAB subscales of condom use value (r = -.541, p = < .001), condom use monitoring (r = -.482, p < .001), and condom use planning (r = -.468, p = .001), but not condom use self-efficacy (r = -.130, p = .374). There were also significant negative correlations with the condom use intentions scale (r = -.501, p < .001) and the MCAS pleasure subscale (r = -.495, p < .001), but not with the MCAS identity stigma (r = -.130, p = .375) or embarrassment about negotiation and use (r = -.194, p = .181) subscales.

Urgency and self-control (see Table 4). There were no significant correlations between mean effort discounting scores and any of the S-UPPS-P subscales, BSCS total score, or BSCS subscale scores.

Risky sexual acts (see Table 5). There was a significant positive correlation between mean effort discounting task scores and the SRS uncommitted partners subscale (r = .321, p = .026), but not with the risky sexual acts (r = .109, p = .462), impulsive behavior (r = .153, p = .292), intentions for risky sex (r = -.122, p = .404), or anal sex (r = .068, p = .645) subscales.

Condom purchase task (see Table 6). There were no significant correlations between mean effort discounting task scores and any of the observed or derived outcomes of the condom purchase task.

Condom Discounting Task.

Sexual behavior (see Table 2). There were no significant correlations between mean condom discounting task scores and SBQ measures of sexual behavior.

Self-regulatory cognitions related to condom use (see Table 3). Mean condom discounting task scores were significantly negatively correlated with the GSAB subscales of condom use value ($r = -.367$, $p = .012$), condom use monitoring ($r = -.473$, $p = .001$), and condom use planning ($r = -.409$, $p = .005$), but not condom use self-efficacy ($r = -.193$, $p = .200$). There were also significant negative correlations with the condom use intentions scale ($r = -.404$, $p = .005$) and the MCAS pleasure subscale ($r = -.482$, $p = .001$), but not with the MCAS identity stigma ($r = -.070$, $p = .646$) or embarrassment about negotiation and use ($r = -.189$, $p = .208$) subscales.

Urgency and self-control (see Table 4). There were no significant correlations between mean condom discounting scores and any of the S-UPPS-P subscales, BSCS total score, or BSCS subscale scores.

Risky sexual acts (see Table 5). There was a significant positive correlation between mean condom discounting task scores and the SRS uncommitted partners subscale ($r = .363$, $p = .014$), but not with the risky sexual acts ($r = .216$, $p = .153$), impulsive behavior ($r = .137$, $p = .364$), intentions for risky sex ($r = -.093$, $p = .538$), or anal sex ($r = .101$, $p = .507$) subscales.

Condom purchase task (see Table 6). There were no significant correlations between mean condom discounting task scores and any of the observed or derived outcomes of the condom purchase task.

Monetary Equivalence Task

Sexual behavior (see Table 2). There were no significant correlations between mean monetary discounting task scores and SBQ measures of sexual behavior.

Self-regulatory cognitions related to condom use (see Table 3). Mean monetary equivalence task scores were significantly negatively correlated with the GSAB subscales of condom use value ($r = -.363$, $p = .012$), condom use monitoring ($r = -.355$, $p = .014$), condom use planning ($r = -.395$, $p = .006$), and condom use self-efficacy ($r = -.362$, $p = .012$). There were also significant negative correlations with the condom use intentions scale ($r = -.417$, $p = .004$) and the MCAS identity stigma subscale ($r = -.549$, $p < .001$), but not with the MCAS pleasure ($r = -.277$, $p = .060$) or embarrassment about negotiation and use ($r = -.156$, $p = .296$) subscales.

Urgency and self-control (see Table 4). There were no significant correlations between mean monetary equivalence scores and any of the S-UPPS-P subscales, BSCS total score, or BSCS subscale scores.

Risky sexual acts (see Table 5). There were no significant correlations between mean monetary equivalence scores and any of the SRS subscales.

Condom purchase task (see Table 6). There were no significant correlations between mean monetary equivalence task scores and any of the observed or derived outcomes of the condom purchase task.

Primary Multilevel Analyses

The following primary analyses examined the effects of alcohol consumption on the outcomes of the effort discounting, condom discounting, and monetary equivalence

tasks. Alcohol consumption was modeled in two different ways: first, the effect of any alcohol consumption was examined (i.e., alcohol consumption was coded as a dichotomous predictor, either yes or no); and second, the effect of number of standard drinks consumed prior to completing the tasks (i.e., alcohol consumption was used as a continuous predictor). As noted previously, the dependent variables were coded so that increases in AOC (for the condom discounting and effort discounting tasks) and increases in AUC (for the monetary equivalence task) were associated with greater risk (i.e., reduced likelihood of expending effort to obtain a condom, reduced likelihood of waiting to have anal intercourse with a condom, and increased likelihood of choosing to have CAI over earning money, respectively). Data were initially analyzed with linear multilevel regression models with random slopes in Mplus version 8.5 (Muthén & Muthén, 2021). If variation in the random slopes was not significant, models were re-run with fixed rather than random effects. At level one, alcohol consumption, elapsed days in the study, and six day-of-the-week indicators (with Sunday as the reference day) were used as predictors. At level two, cluster mean values for alcohol consumption and age were used as a predictors. Apart from the six day-of-the-week predictors, continuous and dichotomous level one variables were centered at the person-mean and continuous and dichotomous level two variables were centered at the grand-mean to allow decomposition and estimation of within- and between-subjects effects.

Effort Discounting Task

Effect of any alcohol consumption. In the random effects model, the random slope between alcohol consumption and AOC did not have significant variation (p =

.988), so the analysis was re-run with fixed rather than random effects. In the fixed effects model, the within-subjects effect of any alcohol consumption on AOC was significant (b = 5.259, p = .004), indicating that participants were less likely to expend effort to obtain condoms after consuming alcohol. Between-subjects, any alcohol consumption was also associated with greater AOC, but the effect was not significant (b = 24.018, p = .249). There was no within-subjects effect of elapsed study day or day of the week. The between-subjects effect was age was not significant (b = -0.080, p = .888). See Table 7 for full results.

Effect of number of drinks. In the random effects model, the random slope between number of drinks and AOC did not have significant variation (p = .690), so the analysis was re-run with fixed rather than random effects. In the fixed effects model, the within-subjects causal effect of number of drinks on AOC was significant (b = 1.121, p = .009), whereas between-subjects, there was a positive association between number of drinks and AOC, but the effect was not significant (b = 2.641, p = .586). There was no within-subjects effect of elapsed study day or day of the week. The between-subjects effect of age was not significant (b = 0.013 p = .983). See Table 8 for full results. Similar to the results described immediately above, this means that there was a dose-dependent effect of alcohol on willingness to expend effort to obtain condoms prior to having sex: with each additional standard drink, participants were significantly less likely to expend effort on a within-subjects basis.

Condom Discounting Task

Effect of any alcohol. In the random effects model, the random slope between alcohol consumption and AOC did not have significant variation (p = .998), so the analysis was re-run with fixed rather than random effects. In the fixed effects model, the within-subjects effect of any alcohol consumption was not in the hypothesized direction (i.e., any alcohol consumption was associated with reduced rather than increased AOC), but the effect was not significant (b = -3.467, p = .571), indicating that alcohol consumption prior to task completion did not change the likelihood that participants would choose to have immediate sex without a condom rather than wait to have sex with a condom. The between-subjects effect of any alcohol was in the hypothesized direction but was not significant (b = 44.969, p = .133). Of the six day-of-the-week indicators, only Monday was significant, indicating significantly reduced AOC when compared to Sunday (b = -21.444, p = .006) at the within-subjects level. There was no effect of elapsed study days (b = -0.364, p = .353). The between-subjects effect of age was not significant (b = -0.378, p = .667). See Table 9 for full results.

Effect of number of drinks. In the random effects model, the random slope between alcohol consumption and AOC did not have significant variation (p = .950), so the analysis was re-run with fixed rather than random effects. In the fixed effects model, the within-subjects effect of number of drinks was in the hypothesized direction (i.e., number of drinks consumed was associated with greater AOC), but the effect was not significant (b = 0.443, p = .741), indicating a lack of significant dose-dependent effects of alcohol on the likelihood of choosing immediate CAI over waiting to have sex with a

condom. The between-subjects effect of any alcohol was also not significant (b = 1.555, p = .829). Of the six day-of-the-week indicators, only Monday was significant, indicating significantly reduced AOC when compared to Sunday (b = -20.818, p = .006) at the within-subjects level. There was no effect of elapsed study days (b = -0.336, p = .382). The between-subjects effect of age was not significant (b = -0.133, p = .893). See Table 10 for full results.

Monetary Equivalence Task

Effect of any alcohol. In the random effects model, the random slope between alcohol consumption and AUC did not have significant variation (p = .405), so the analysis was re-run with fixed rather than random effects. In the fixed effects model, the within-subjects effect of any alcohol consumption was in the hypothesized direction (i.e., any alcohol consumption was associated with greater AUC), but the effect was not significant (b = 34.287, p = .083), indicating that alcohol consumption prior to task completion did not increase the likelihood that participants would choose to have an episode of CAI rather than earn money. The between-subjects effect of any alcohol was also not significant (b = -3.797, p = .978). None of the six day-of-the-week indicators was significant, nor was elapsed study day a significant within-subjects predictor of AUC (b = -0.847, p = .380). The between-subjects effect of age was significant (b = 7.582, p = .004), however, indicating that as age increased, so did the likelihood of choosing CAI over earning an increasing amount of money. See Table 11 for full results.

Effect of number of drinks. In the random effects model, the random slope between alcohol consumption and AOC did not have significant variation (p = .314), so

the analysis was re-run with fixed rather than random effects. In the fixed effects model, the within-subjects effect of any alcohol consumption was in the hypothesized direction (i.e., number of drinks consumed was associated with greater AUC, or greater likelihood of choosing to have an episode of CAI over earning money), but the effect was not significant (b = 8.547, p = .110). The between-subjects effect of any alcohol was also not significant (b = -3.575, p = .913). None of the six day-of-the-week indicators was significant, nor was elapsed study day a significant within-subjects predictor of AUC (b = -0.952, p = .340). As above, the between-subjects effect of age was significant (b = 7.559, p = .002), indicating that as age increased, so did the likelihood of choosing CAI over earning an increasing amount of money. See Table 12 for full results.

Secondary Multilevel Analyses

The following secondary multilevel analyses tested the hypotheses that (1) for all three tasks, more-attractive partners will increase the effects of intoxication the discounting/monetary equivalence task outcomes, and (2) for all three tasks, greater sexual arousal will increase the effects of intoxication on the discounting/monetary equivalence task outcomes. They also examined the effects of heavy drinking on task outcomes, with heavy drinking defined as five or more drinks consumed prior to task completion. Partner attractiveness scores were collected prior to each iteration of the three tasks and were based on participant reactions to photographs of potential male sexual partners that were displayed before each task. A different photo was shown before each iteration of each task, with no duplicate images used during the study. Based on the images, participants were asked to rate how attractive they found each of the potential

partners, using an eight-point Likert-like scale from 0 (“not at all”) to 7 (“extremely”). Sexual arousal was measured by taking the mean of two questions that were asked during each evening survey, each of which was answered with an eight-point Likert-like scale from 0 (“not at all”) to 7 (“extremely”). The first question asked “how sexually aroused are you right now?” and the second question asked “how horny are you right now?”.

To run the analyses, the fixed-effects multilevel models used in the primary analyses were modified with the addition of (1) partner attractiveness, or (2) sexual arousal as within- and between-subjects predictors of task outcomes, along with a within-subjects interaction term between each of these two new independent variables and alcohol use. As in the primary analyses, alcohol use was examined in two ways: first as a dichotomous predictor indicating use or non-use, and second as a continuous predictor based on the number of standard drinks consumed prior to completing the tasks. The six day-of-the-week indicators were kept as predictors at the within-subjects level, along with the measure of elapsed study days. Age was included as a covariate at the between-subjects level. Where significant interactions emerged at the within-subjects level, they were analyzed with the use of simple slopes (e.g., Aiken & West, 1991) at pre-determined values (a “low” value of the moderator at one-standard deviation below its mean, a “medium” value of the moderator at its mean, and a “high” value of the moderator at one standard deviation above its mean) and then plotted in Mplus to determine the region(s) of significance of the interaction.

Effort Discounting Task

Partner Attractiveness

In the moderated fixed-effects model of any alcohol consumption and partner attractiveness on AOC, the within-subjects effect of any alcohol consumption on AOC was significant (b = 4.909, p = .006), but the within-subject effects of partner attractiveness (b = 1.093, p = .120) and the interaction term (any alcohol use x partner attractiveness, b = -1.557, p = .201) were not, indicating that partner attractiveness did not significantly affect the likelihood that participants would expend effort to obtain condoms prior to having sex. As in previous models, none of the six day-of-the-week indicators was significantly different from the Sunday reference day, nor was elapsed study day a significant predictor at the within-subjects level (b = -0.210, p = .141). At level two, none of the between-subjects predictors was a significant predictor of AOC. See Table 13 for full results.

In the moderated fixed-effects model of standard drinks and partner attractiveness on AOC, the within-subjects effect of standard drinks on AOC was significant (b = 1.184, p = .008), but like in the analysis described immediately above, the within-subjects effects of partner attractiveness (b = 1.194, p = .101) and the interaction term (standard drinks x partner attractiveness, b = -0.034, p = .980) were not significant. None of the six day-of-the-week indicators was significantly different from the Sunday reference day, nor was elapsed study a significant predictor at the within-subjects level (b = -0.219, p = .127). At level two, none of the between-subjects predictors was a significant predictor of AOC. See Table 14 for full results.

Sexual Arousal

In the moderated fixed-effects model of any alcohol consumption and sexual arousal on AOC, the within-subjects effect of any alcohol consumption on AOC was significant (b = 4.243, p = .008), but the within-subject effects of sexual arousal (b = 2.112, p = .104), and the interaction term (any alcohol use x sexual arousal, b = -1.861, p = .216) were not, indicating that sexual arousal did not impact willingness to expend effort to acquire a condom prior to having sex. As in previous models, none of the six day-of-the-week indicators was significantly different from the Sunday reference day, nor was elapsed study day a significant predictor at the within-subjects level (b = -0.210, p = .121). At level two, none of the between-subjects predictors was a significant predictor of AOC. See Table 15 for full results.

In the moderated fixed-effects model of standard drinks and sexual arousal on AOC, the within-subjects effect of standard drinks on AOC was significant (b = 0.920, p = .049), but the effect of sexual arousal (b = 2.124, p = .112) and the interaction effect between standard drinks and sexual arousal (b = -0.331, p = .185) were not, replicating the results described immediately above. As in previous models, none of the six day-of-the-week indicators was significantly different from the Sunday reference day, nor was elapsed study day a significant predictor at the within-subjects level (b = -0.226, p = .105). At level two, none of the between-subjects predictors was a significant predictor of AOC. See Table 16 for full results.

Heavy Drinking

In the fixed effects model of heavy drinking on AOC, the within-subjects effect of heavy drinking was in the hypothesized direction (i.e., heavy drinking was associated with greater AOC), but the effect was not significant (b = 2.788, p = .344), indicating that heavy drinking episodes were not predictive of reduced effort to obtain condoms prior to having sex. The between-subjects effect of heavy drinking was also not significant (b = 19.890, p = .615). As in previous models, none of the six day-of-the-week indicators was significantly different from the Sunday reference day, nor was elapsed study day a significant predictor at the within-subjects level (b = -0.225, p = .115). The between-subjects effect of age was not significant (b = 0.025, p = .968). See Table 17 for full results.

Condom Discounting Task

Partner Attractiveness

In the moderated fixed-effects model of any alcohol consumption and partner attractiveness on AOC, the within-subjects effect of any alcohol consumption on AOC was not significant (b = 0.234, p = .970), while the within-subject effects of partner attractiveness was significant (b = 6.937, p < .001) and the interaction term (any alcohol use x partner attractiveness, b = -2.173, p = .480) was not. This finding indicates that participants became more likely to prefer an immediate episode of CAI rather than wait to have sex with a condom when partners were perceived as more attractive. The within-subjects effect of elapsed study day was not significant (b = -0.518, p = .168), whereas AOC on Mondays was significantly reduced from AOC on Sundays (b = -17.675, p =

.017). None of the remaining six-day-of-the-week indicators was significantly different from the Sunday reference day. At level two, none of the between-subjects terms was a significant predictor of AOC. See Table 18 for full results.

In the moderated fixed-effects model of standard drinks and partner attractiveness on AOC, the within-subjects effect of standard drinks on AOC was not significant (b = 0.980, p = .477), while the within-subject effects of partner attractiveness was significant (b = 7.506, p < .001) and the interaction term (standard drinks x partner attractiveness, b = -1.612 p = .626) was not. This replicates the finding described immediately above, that more attractive partners predicted greater likelihood of immediate sex without a condom rather than waiting to have sex with a condom. The within-subjects effect of elapsed study day was not significant (b = -0.511, p = .164), whereas AOC on Mondays was significantly reduced from AOC on Sundays (b = -16.778, p = .018). None of the remaining six-day-of-the-week indicators was significantly different from the Sunday reference day. At level two, none of the between-subjects terms was a significant predictor of AOC. See Table 19 for full results.

Sexual Arousal

In the moderated fixed-effects model of any alcohol consumption and sexual arousal on AOC, the within-subjects effect of any alcohol consumption on AOC was not significant (b = -5.696, p = .336), the within-subject effects of sexual arousal was not significant (b = 1.746, p = .147), and the interaction term (any alcohol use x sexual arousal, b = 7.986, p = .078) was not significant. Here, these findings indicate that sexual arousal did not affect the likelihood that participants would choose immediate CAI over

waiting to have sex with a condom. The within-subjects effect of elapsed study day was not significant (b = -0.359, p = .366), whereas AOC on Mondays was significantly reduced from AOC on Sundays (b = -22.073, p = .005). None of the remaining six-day-of-the-week indicators was significantly different from the Sunday reference day. At level two, none of the between-subjects terms was a significant predictor of AOC. See Table 20 for full results.

In the moderated fixed-effects model of standard drinks and sexual arousal on AOC, the within-subjects effect of standard drinks on AOC was not significant (b = -1.127 p = .484), nor was the effect of sexual arousal on AOC (b = 1.762, p = .461), but there was a significant interaction term (standard drinks x sexual arousal, b = 0.816, b = .023). The within-subjects effect of elapsed study day was not significant (b = -0.332, p = .395), whereas AOC on Mondays was significantly reduced from AOC on Sundays (b = -21.772, p = .005). None of the remaining six-day-of-the-week indicators was significantly different from the Sunday reference day. At level two, none of the between-subjects terms was a significant predictor of AOC. See Table 21 for full results.

As noted immediately above, within-subjects, sexual arousal was a significant moderator (b = 0.816, p = .023) of the effect of alcohol consumption on AOC. A simple slopes analyses (probed at the mean and +/- one SD of sexual arousal, see Figure 4) revealed that alcohol consumption had non-significant negative effects on AOC at low (b = -2.295, p = .270) and mean (b = -1.127, p = .484) levels of sexual arousal, whereas at high (b = 0.042, p = .971) levels of sexual arousal, alcohol consumption led to a non-significant increase in AOC. Using Mplus to visualize the effect of standard drinks on

arousal, the region of significance for the interaction effect of standard drinks and sexual arousal was noted to extended from approximately 1.75 standard drinks above average up to the maximum level of drinking, which was 11 standard drinks above average. These findings suggest that above 1.75 standard drinks above average, alcohol had minimal effects on AOC for those high in sexual arousal, but for those lower in sexual arousal, increased alcohol consumption predicted lower levels of AOC.

Heavy Drinking

In the fixed effects model of heavy drinking on AOC, the within-subjects effect of heavy drinking was in the hypothesized direction (i.e., heavy drinking was associated with greater AOC), but the effect was not significant (b = 7.263, p = .423), indicating that heavy drinking prior to task completion did not affect the likelihood that participants would wait to have sex with a condom versus having immediate sex without a condom. The between-subjects effect of heavy drinking was also not significant (b = -6.027, p = .911). The within-subjects effect of elapsed study day was not significant (b = -0.335, p = .382), whereas AOC on Mondays was significantly reduced from AOC on Sundays (b = -20.421, p = .007). None of the remaining six-day-of-the-week indicators was significantly different from the Sunday reference day. The between-subjects effect of age was not significant (b = -0.121, p = .904). See Table 22 for full results.

Monetary Equivalence Task

Partner Attractiveness

In the moderated fixed-effects model of any alcohol consumption and partner attractiveness on AUC, the within-subjects effect of any alcohol consumption on AUC

was in the hypothesized direction but was not significant (b = 23.157, p = .170), while the within-subjects effect of partner attractiveness (b = 33.455, p < .001) was significant and the interaction term (any alcohol use x partner attractiveness, b = 7.458, p = .395) was not. Here, this finding indicates that participants were more likely to choose to have an episode of CAI rather than earn money when potential partners were rated as more attractive. Neither elapsed study day (b = -0.787, p = .454) nor any of the six day-of-the-week indicators were significant within-subjects predictors of AUC. At level two, neither the between-subjects effect of any alcohol on AUC (b = -8.811, p .944) nor the between-subjects effect of partner attractiveness (b = 51.031, p = .191) were significant, but the between-subjects effect of age on AUC was significant (b = 7.035, p = .004), revealing an relationship between increased age and greater likelihood of choosing to have an episode of CAI over earning increasing amounts of money. See Table 23 for full results.

In the moderated fixed-effects model of standard drinks and partner attractiveness on AUC, the within-subjects effect of any alcohol on AUC was not significant (b = 4.472, p = .276), while the within-subjects effect of partner attractiveness (b = 33.390, p < .001) was significant and the interaction term (standard drinks x partner attractiveness, b = -0.470, p = .772) was not. This finding replicates the results described immediately above, that more attractive partners predicted a greater preference for an episode of CAI instead of earning money. Elapsed study day was not a significant predictor of AUC at the within-subjects level (b = -0.808, p = .436), nor were any of the six day-of-the-week indicators significantly different from the Sunday reference day. At level two, neither the between-subjects effect of any alcohol on AUC (b = 3.111, p = .911), nor the between-

subjects effect of partner attractiveness (b = 51.323, p = .177) were significant, while the between-subjects effect of age on AUC was significant (b = 7.005, p = < .001), revealing a relationship between increased age and greater likelihood of choosing to have an episode of CAI over earning increasing amounts of money. See Table 24 for full results.

Sexual Arousal

In the moderated fixed-effects model of any alcohol consumption and sexual arousal on AUC, the within-subjects effect of any alcohol consumption on AUC was not significant (b = 32.036, p = .122), the within-subjects effect of sexual arousal was not significant (b = 2.493, p = .454), and the interaction term (any alcohol use x sexual arousal, b = 1.156, p = .919) was also not significant. This indicates that sexual arousal did not predict significant changes in the likelihood of choosing to have an episode of CAI rather than earn money. Elapsed study day was not a significant predictor of AUC at the within-subjects level (b = -0.840, p = .375), nor were any of the six day-of-the-week indicators significantly different from the Sunday reference day. At level two, neither the between-subjects effect of any alcohol on AUC (b = -7.342, p = .951), nor the between-subjects effect of sexual arousal (b = 2.199, p = .932) were significant, while the between-subjects effect of age on AUC was significant (b = 7.586, p = .004), revealing a relationship between increased age and greater likelihood of choosing to have an episode of CAI over earning increasing amounts of money. See Table 25 for full results.

In the moderated fixed-effects model of standard drinks and sexual arousal on AUC, the within-subjects effect of standard drinks on AUC was not significant (b = 8.224, p = .132), the within-subjects effect of partner attractiveness was not significant (b

= 2.780, p = .345), and the interaction term (standard drinks x sexual arousal, b = -1.189, p = .550) was also not significant, replicating the results described immediately above. Elapsed study day was not a significant predictor of AUC at the within-subjects level (b = -0.939, p = .345), nor were any of the six day-of-the-week indicators significantly different from the Sunday reference day. At level two, neither the between-subjects effect of any alcohol on AUC (b = -4.176, p = .887), nor the between-subjects effect of sexual arousal (b = 2.741, p = .923) were significant, while the between-subjects effect of age on AUC was significant (b = 7.553, p = .002), revealing a relationship between increased age and greater likelihood of choosing to have an episode of CAI over earning increasing amounts of money. See Table 26 for full results.

Heavy Drinking

In the fixed effects model of heavy drinking on AUC, the within-subjects effect of heavy drinking was in the hypothesized direction (i.e., heavy drinking was associated with greater AUC), but the effect was not significant (b = 43.040, p = .278), indicating that heavy drinking prior to task completion did not have a significant effect on task outcomes. The between-subjects effect of heavy drinking was also not significant (b = -120.324, p = .592). The within-subjects effect of elapsed study day was not significant (b = -1.069, p = .279) and none of the six-day-of-the-week indicators was significantly different from the Sunday reference day. As in the previous secondary multilevel analyses of the monetary equivalence task, the between-subjects effect of age was significant (b = 7.484, p = .002). See Table 27 for full results.

Point-by-Point Analyses

Based on the primary and secondary analyses described above, a third set of multilevel analyses was carried out to examine how alcohol (for all three tasks) and partner attractiveness (for the condom discounting and monetary equivalence tasks) affected outcomes at each discounting and equivalence point for the tasks. The purpose of these analyses was to better characterize the effects of these predictors across the range of discounting and equivalence points used in each task, to help determine whether there were significant differences at certain points and not others. In past research, these analyses have been conducted for the zero-delay point only (Berry et al., 2022; Dariotis & Johnson, 2015; Herrmann et al., 2014, 2015; M. W. Johnson & Bruner, 2012; P. S. Johnson et al., 2016; Wongsomboon & Robles, 2017) whereas in the present study, these analyses were extended to include all discounting and equivalence points. In addition, the following analyses were conducted with (1) unstandardized data, and (2) the inclusion of the zero trials for each task (i.e., trials in which participants indicated that there was zero likelihood of expending any effort to obtain a condom or using an immediately available condom in the two discounting trials, or zero likelihood of choosing to have an episode of CAI instead of earning $1 in the monetary equivalence task). In the primary and secondary analyses above, the zero trials were removed because standardization would have required dividing all subsequent discounting and equivalence points by zero, yielding undefined results. Using unstandardized data for the following analyses allowed the zero trials to be included.

Inclusion of the zero trials had advantages and disadvantages. Because the major aim of this study was to identify how alcohol and other contextual variables affected within-subjects patterns of responding to the three tasks, removing the zero trials from the primary and secondary analyses decreased potentially important variability in participant responses. For example, imagine a trial in which a participant indicated that he would never expend effort to obtain a condom (e.g., he provided responses of 0% likelihood of expending effort at every delay point, and that trial was then excluded from the primary and secondary analyses), but if that trial represented task responses after drinking, and that same participant indicated that he would be likely to expend some amount of effort when sober, then removal of the zero trial would preclude recognition of that effect. At the same time, the reason for using standardized data was to isolate and then remove the effect of preference for or against expending any effort, using an immediately available condom, or choosing to have an episode of CAI rather than earn $1, so that standardized discounting and equivalence values at each delay and equivalence point represented the effects of delay or equivalence only and were not confounded with these zero-delay preferences. The analyses listed below, therefore, preserved important variability in participant responses that was not included in the primary and secondary analyses.

Similar to the primary and secondary analyses, data for the point-by-point analyses were analyzed with fixed linear multilevel regression models in Mplus version 8.5 (Muthén & Muthén, 2021). At level one, alcohol consumption (both as any alcohol consumed and standard drinks) or partner attractiveness, elapsed day in the study, and six day-of-the-week indicators (with Sunday as the reference day) were used as predictors.

At level two, cluster mean values for alcohol consumption or partner attractiveness and age were used as predictors. Apart from the six day-of-the-week predictors, continuous and dichotomous level one variables were centered at the person-mean and continuous and dichotomous level two variables were centered at the grand-mean to allow decomposition and estimation of within- and between-subjects effects. Prior to analyses, AOC and AUC values were scaled down by a factor of 100 because unscaled values exceeded the maximum variance allowed by Mplus for multilevel analyses.[3]

Effort Discounting Task

Full results of the point-by-point analysis are shown in Table 28. With the addition of the zero trials, there was a significant within-subjects alcohol-related increase in total AOC when alcohol was measured as any consumption prior to task completion (b = 4.766, p = .011). When alcohol consumption was measured in standard drinks, however, the within-subjects effect on AOC was not significant (b = .914, p = .056).

Looking at individual effort discounting points, for any alcohol consumption, there were significant within-subjects differences at all effort discounting points except for 0 minutes (b = -3.823, p = .078) and 120 minutes (-2.053, p = .259), whereas for alcohol consumption measured in standard drinks, significant within-subjects differences

[3] Computing AOC and AUC with non-standardized likelihood values (which vary between 0 and 100%) produced large results. For example, for the effort discounting task, the maximum AOC was 12,000, which is the product of 120 minutes x 100% likelihood. Scaling down by a factor of 100 results in a maximum AOC of 120, which is within the variance limits of Mplus. Maximum AOC for the condom discounting task was 16,800 (168 hours x 100% likelihood) while the maximum AUC for the monetary equivalence task was 99,900 ($999 dollars X 100% likelihood). After scaling, this resulted in a maximum AOC of 168 for the effort discounting task and a maximum AUC of 999 for the monetary equivalence task.

were observed only at the 10- (b = -1.845, p = .024) and 60-minute (b = -0.729, p = .040) discounting points.

Condom Discounting Task

Full results of the point-by-point analysis are shown in Table 29. The effects of alcohol and partner attractiveness on total AOC followed the patterns observed in the primary and secondary analyses: while neither any alcohol (b = -1.761, p = .721) nor standard drinks (b = 0.573, p = .546) had significant within-subjects effects on AOC, partner attractiveness did significantly predict AOC (b = 6.266, p < .001) at the within-subjects level, such that more attractive potential partners were associated with reduced likelihood of waiting to use a condom across the entire task.

When looking at individual condom discounting points, there were no points at which alcohol consumption led to significant within-subjects effects, for both any alcohol consumption and consumption measured in standard drinks. Partner attractiveness, however, predicted a reduced within-subjects likelihood of waiting to use a condom at all points except for 10 minutes (b = 0.100, p = .874), 20 minutes (b= = -0.299, p = .649), and one hour (b = -0.986, p = .170) of waiting time. Interestingly, for the subsequent discounting points, the significance of the within-subjects effect increased in tandem with the waiting time, so that longer waiting periods were associated with more significant effects of potential partner attractiveness: for example, waiting two hours (b = -2.355) had a p-value of .009, whereas waiting for seven days (b = -4.043) had a p-value of < .001. This suggests that choosing immediate condomless sex became more important to participants as the waiting time to have sex with a condom increased.

Monetary Equivalence Task

Full results of the point-by-point analysis are shown in Table 30. The within-subjects effects of alcohol and partner attractiveness on total AUC followed the patterns observed in the primary and secondary analyses: while neither any alcohol ($b = 8.026$, $p = .558$) nor standard drinks ($b = 2.476$, $p = .441$) had significant within-subjects effects on AUC, partner attractiveness did significantly predict AUC ($b = 32.894$, $p < .001$), such that more attractive potential partners were associated with a greater within-subjects likelihood of choosing an episode of CAI rather than earning money over the entirety of the task.

When looking at individual monetary discounting points, there were no points at which alcohol consumption led to significant within-subjects effects, for both any alcohol consumption and consumption measured in standard drinks. Partner attractiveness, however, predicted greater likelihood of choosing to have an episode of CAI at every equivalence point.

Discussion

Correlational Analyses

To examine the ecological validity of the EMA motivational measures, mean participant scores from the three daily survey tasks were correlated with outcomes from the baseline questionnaires. As described above, scores for all three tasks were calculated so that greater scores (in terms of AOC for the effort discounting and condom discounting tasks, and AUC for the monetary equivalence task) indicated a greater preference for condomless sex and thus greater sexual risk. Results from correlational analyses suggested ecological validity for each of the three tasks.

For the novel effort discounting task, significant negative associations emerged between mean task scores and the frequency of condom use during sexual encounters on the SBQ, providing evidence that greater AOC—which is hypothesized to represent greater sexual risk—was associated with a reduced tendency to use condoms during sex. A significant positive association was also observed between the SRS uncommitted partners subscale and mean effort discounting scores, indicating that task outcomes were associated with a greater incidence of sex with casual and anonymous partners. Over the past two decades, MSM have become increasingly likely to engage in CAI with uncommitted partners (Klein, 2012; Pantalone et al., 2015), suggesting that the positive association between mean effort discounting task scores and the SRS uncommitted partners subscale represent increased potential for HIV infection among high-scoring MSM. Together, these significant associations provide evidence that the construct

measured by the task (i.e., the likelihood of expending effort to obtain condoms prior to a sexual encounter) is related to real-world, behavioral measures of sexual risk.

Several significant correlations also emerged between effort discounting scores and measures of self-regulatory cognitions related to condom use: increases in effort discounting scores were significantly associated with reduced intentions to use condoms, lower perceived value of the goal of using condoms, and reductions in planning for and monitoring of condom use. In addition, a significant negative correlation with the pleasure subscale of the MCAS indicated that greater effort discounting scores were associated with more negative attitudes toward the idea that sex with condoms can be pleasurable. Like the significant correlations with behavioral outcomes described above, these associations suggest that scores on the effort discounting task provided a valid index of self-regulatory cognitions about condom use, such that greater effort discounting scores were associated with cognitions that are linked with more risky sexual behavior (Abraham et al., 1999; Golub et al., 2010; Luehring-Jones et al., 2019; Sheeran et al., 1999; Tahaney et al., 2019; Teng & Mak, 2011).

The condom discounting task was first described in 2012 by M.W. Johnson and Bruner and has since been used, either in its original or modified forms, in numerous studies of sexual delay discounting (Berry et al., 2019, 2022; Collado et al., 2017; Dariotis & Johnson, 2015; Herrmann et al., 2014, 2015; M. W. Johnson et al., 2015; M. W. Johnson & Bruner, 2013; P. S. Johnson et al., 2016; Jones, Guest, Sullivan, Kramer, et al., 2018; Jones, Guest, Sullivan, M. Sales, et al., 2018; Wongsomboon & Robles, 2017). As administered in this study, the condom discounting task was not significantly

related to risky sexual behaviors as assessed by the SBQ, but was significantly positively associated with the SRS uncommitted partners subscale, indicating that greater task scores were associated with a heightened propensity to engage in sexual relations with casual or anonymous partners. Like with the effort discounting task, scores from the condom discounting task were also significantly negatively correlated with several self-regulatory cognitions related to condom use, including condom use value, condom use planning, condom use monitoring, intentions to use condoms, and the MCAS pleasure subscale. These significant correlations indicate that greater scores on the condom discounting task were related to lower levels of cognitions that promote and value condom use. When considered together, these results suggest that the condom discounting task does supply an ecologically valid measure of sexual risk: between-subjects, as mean condom discounting task scores increased: (1) sexual encounters with uncommitted partners increased, (2) self-regulatory cognitions related to condom use became weaker, and (3) pleasure associated with condom use decreased.

As with the condom discounting task scores, there were no significant correlations between mean monetary equivalence task scores and SBQ measures of sexual behavior. In addition, there were also no significant correlations with any of the SRS subscales of risky sexual behavior. There were, however, significant negative correlations with measures of self-regulatory cognitions related to condom use, including intentions to use condoms and condom use value, self-efficacy, monitoring, and planning scores. In addition, there were also significant negative correlations with the MCAS identity stigma subscale score, indicating that greater monetary equivalence task scores were associated

with more negative feelings toward men who suggest condom use during sexual encounters. As with the effort and condom discounting tasks, these findings demonstrate that greater monetary equivalence task scores were associated with cognitions that are related to more risky sexual behavior.

These correlational analyses allow several conclusions to be drawn about the daily survey tasks used in this study. First, they provide evidence that scores from the effort and condom discounting tasks were associated with real-world sexual risk behavior, an important finding that supports their use as ecologically valid measures of sexual risk. The absence of such correlations with the monetary equivalence task raises questions about the validity of the construct it was hypothesized to measure. It may be that money and sexual behavior are not cognitively interchangeable concepts, such that the method of valuation for one may not match the other. There is some experimental evidence to suggest that this may be the case: in studies that have examined both sexual and monetary discounting, researchers have found discounting outcomes between the two types of rewards to be only slighted related, with consistently small associations between sexual risk behaviors and greater monetary discounting (Celio et al., 2016; Cheng & Chiou, 2018; Chesson et al., 2006; M. W. Johnson et al., 2021; Khurana et al., 2012; Lawyer & Mahoney, 2018; MacKillop et al., 2015; Reimers et al., 2009; Sparks et al., 2014), including among MSM (Jones & Sullivan, 2015, 2016). These findings have been interpreted as evidence for "domain specificity" in discounting processes (M. W. Johnson et al., 2015, p. 15), which proposes that discounting patterns are specific to the type of commodity discounted. The monetary equivalence task, which attempted to express the

value of riskless CAI in monetary terms, may have been impacted by the nonfungibility of those two concepts.

At the same time, however, all three tasks were significantly and negatively associated with self-regulatory cognitions related to condom use that have been found to predict and/or be significantly related to sexual risk behaviors in MSM and heterosexual populations (Abraham et al., 1999; Golub et al., 2010; Luehring-Jones et al., 2019; Sheeran et al., 1999; Tahaney et al., 2019; Teng & Mak, 2011). There is a rich literature on the impact of self-regulatory cognitions not only on sexual behavior, but on other outcomes of vital importance to health and wellbeing (e.g., Ajzen, 1991; Ajzen & Madden, 1986; J. D. Fisher & Fisher, 1992). Given the potent impact that self-regulatory cognitions can have on decisions that impact the riskiness of sexual behavior, the fact that higher scores on all three tasks were significantly negatively associated with self-regulatory cognitions related to condom use provides additional evidence in support of the hypothesis that these tasks assessed sexual risk in an ecologically valid way.

This critical conclusion supports the use of the tasks in the way envisioned by this study, as measures of sexual risk that are subject to daily perturbations by contextual factors like alcohol consumption, partner attractiveness, and sexual arousal that impact motivation to engage in safer sexual behavior. The impact of those contextual factors on sexual risk will be discussed below.

Primary Multilevel Analyses

The primary multilevel analyses examined the impact of alcohol on the effort discounting, condom discounting, and monetary equivalence tasks. Alcohol consumption was modeled in two ways: first as a dichotomous variable indicating whether drinking occurred during the day prior to task administration, and second as a continuous variable of the number of standard drinks consumed prior to task administration. All analyses were first run as random-effects models, but a lack of sufficient within-subjects variation in slope (i.e., the effect of alcohol on task outcomes) indicated that fixed-effects models were a better fit to the task data. In addition to person-mean centered alcohol use as a predictor at level one, elapsed study day and six day-of-the-week indicators (with Sunday as the reference day) were also included. At level two, predictors were alcohol use and age, both of which were grand-mean centered to allow meaningful between-subjects comparisons of the effects of alcohol consumption and age on task outcomes.

For the effort discounting task, there was a significant within-subjects effect of alcohol on AOC, with both any alcohol consumption (versus no drinking) and number of standard drinks predicting significantly higher values of AOC across task administrations. While double-blinded, controlled experiments are the gold-standard method of assessing causal relationships, studies that employ intensive longitudinal methods (Bolger & Laurenceau, 2013) in nonexperimental designs (as was the case in this study) can draw causal inferences based on repeated assessments that use each participant as his or her own control. Here, by repeatedly examining the effect of alcohol

on AOC across multiple task occasions within each participant, evidence for a causal relationship between alcohol use and higher AOC was observed.

The effort discounting task was designed to examine how alcohol use impacts motivation for condom use by assessing how much effort participants would put into obtaining a condom prior to having anal intercourse with a male sexual partner with unknown HIV status. For MSM, making decisions about sexual behavior with incomplete information about risk is something that occurs often in the real world (Horvath et al., 2010; Marcus et al., 2017; Sang et al., 2021). Reflecting this reality, the prompt for the effort discounting task described a sexual situation with unknown HIV and STI variables: "Imagine that he [a new sexual partner] is coming over to your home tonight. He will arrive in 2 hours. After cleaning up your room, you realize that you don't have any condoms. You don't know whether he wants to use condoms, whether he has been recently tested for STIs, whether he is on PrEP, or whether he has had sex with multiple recent partners." A recent study of MSM in San Francisco identified a wide variety of strategies used to ascertain the HIV and STI status of potential partners, including referencing disclosure of HIV status in online profiles, talking about risk factors before and after sex, and guessing (i.e., not engaging in discussion about risk factors before having sex), with guessing associated with a greater likelihood of engaging in CAI (Horvath et al., 2010). In the present study, the effort discounting task was designed to provide only a minimal amount of information about each potential partner, with no source of information that could be used to credibly gauge the level of risk that each potential partner might present. Research has shown that an absence of information

about sexual risk can be interpreted as evidence of low sexual risk (Palfai & Luehring-Jones, 2021; Purdie et al., 2011), a fallacy that likely contributes to the spread of HIV and other STIs.

Armed with little information about the risk of HIV and other STIs, participants were asked to indicate the likelihood that they would spend an increasing amount of time expending effort to obtain a condom prior to having sex with the potential partners pictured at the start of the task. Across task administrations, participants indicated that they would be less likely to expend effort as the effort required to obtain a condom increased. After drinking, the likelihood of expending effort decreased further, leading to substantially larger AOC scores than when sober. Using hypothesized effort as a proxy for motivation (Chong et al., 2016; Spelman & Simons, 2018), the results of this study suggest that alcohol reliably impairs motivation to use a condom because it reduces the amount of effort that participants would expend in order to obtain a condom (the reward) prior to having sex with a potentially risky partner.

In contrast to the effort discounting task, alcohol did not emerge a significant predictor of AOC for the condom discounting task. This finding held true across models of alcohol use—any alcohol consumption and the number of standard drinks consumed—and at both within- and between-subjects levels. These results are inconsistent with previously-reported findings: of the three studies that have examined the effects of substance use on the Johnson and Bruner (2012) sexual delay discounting task through laboratory-based experimental administrations of alcohol (P. S. Johnson et al., 2016), cocaine (M. W. Johnson et al., 2017), and methamphetamine (Berry et al., 2022), both

alcohol and cocaine administration dose-dependently decreased the likelihood of waiting to have condom-protected sex, while methamphetamine did not have a significant effect on sexual delay discounting task outcomes. There is also evidence that individuals with alcohol, cocaine, and opioid dependence discount condom usage at higher rates than controls (Herrmann et al., 2014; Jarmolowicz et al., 2013; M. W. Johnson & Bruner, 2012, 2013; Koffarnus et al., 2016). This is a small evidence base and more research will be needed to replicate and extend these findings.

The absence of a within-subjects effect of alcohol on condom use discounting in this study has potentially important implications for the field of HIV and STI prevention. There is accumulating evidence that alcohol, especially at higher levels of consumption, increases the likelihood of high-risk sexual behaviors among MSM, including CAI (Berry & Johnson, 2018; Hojilla et al., 2018; Koblin et al., 2006; Maisto et al., 2021; Palfai & Luehring-Jones, 2021; Scott-Sheldon et al., 2016; Shuper et al., 2017; Wray, Celio, et al., 2019). Mechanisms for this effect include reduced intentions to use condoms during anal intercourse (Shuper et al., 2017; Wray, Celio, et al., 2019) as well as interference with the behavioral aspects of condom use, such as condom use negotiation (Maisto et al., 2012; Rehm et al., 2012; Scott-Sheldon et al., 2016). One potential interpretation of the findings from this study is that contrary to hypotheses, delay discounting may not be a mechanism of the effect of alcohol on increased rates of CAI among MSM. That is, since alcohol did not significantly decrease the likelihood that participants would wait to have condom-protected sex, it may be that alcohol does not negatively affect the reward value of having delayed anal intercourse with a condom. When considered together with the

results of the effort discounting task, these findings imply that alcohol consumption reduces willingness to exert effort to procure a condom prior to sex but does not make it less likely that MSM will wait to have sex with a condom. The critical difference may be the type of effort required for each outcome. Obtaining a condom likely requires an individual to leave home, travel to a store, and spend money, all of which require an investment of energy and other resources. Waiting to have sex with a condom, however, does not necessarily imply such a substantial allocation of effort. Instead, when intoxicated, waiting to have sex with a condom may be a more palatable option because waiting may be perceived as relatively effortless.

In addition, this study did not detect a within- or between-subjects effect of alcohol on the monetary equivalence task. Contrary to hypotheses, results did not support the view that alcohol influences the value of riskless CAI. Different from the lack of information provided in the instructions for the two discounting tasks, the instructions for the monetary equivalence task specified that that "For the purposes of this set of questions, imagine that you know there is NO RISK of contracting HIV or any other STIs from this partner." This instruction was intended to eliminate potential confounds related to HIV and STI risk that might have impacted how participants responded to the task. In other words, this task was designed to examine how alcohol affects the value of an episode of CAI when there is no potential for negative sexual consequences. As with this condom discounting task, the absence of both within- and between-subjects effects of alcohol on preference for CAI versus earning money suggests that alcohol consumption did not impact the value of having an episode of riskless anal

intercourse without a condom. This may reflect a true lack of preference for CAI after alcohol consumption, but several other interpretations should be considered. First, participants reported a large amount of variability in annual income, so that the possibility of earning money may have been more important for some participants (e.g., those with fewer resources, higher debts, etc.) than others. For example, a relatively wealthy participant might have preferred CAI at every level of potential earnings while a relatively impoverished participant may have felt obligated to always choose money over CAI, regardless of whether he would have truly preferred to engage in CAI. Second, it may be that the situation described in the task—asking participants to choose directly between CAI and earning money—does not reflect a situation that exists in the real world. While all three tasks in this study used hypothetical situations and asked participants to choose between hypothetical rewards (Bickel et al., 2009; Lawyer et al., 2011; Locey et al., 2011; Madden et al., 2003, 2004; Malesza, 2019), both the effort discounting task and the condom discounting task used scenarios that approximated potential real-world situations that may in fact have been experienced by the study's participants. For the condom discounting task, participants were asked to choose between action and inaction (i.e., a choice between expending effort or not), whereas for the condom discounting task they were asked to choose between immediate sex without a condom and delayed sex with a condom. For the monetary equivalence task, however, the situation proffered to participants was likely something they had never encountered before and so may have resulted in confusion or difficulties in making such a choice. A third possibility is that attempting to model equivalence between CAI and money may

not be the best way to measure the value of CAI. Instead, the value of CAI may be better explained by links with other aspects of sexual interactions, few of which can be commodified or expressed in terms of monetary value. These include, potentially, value in terms of pleasure, novelty, opportunities to build or improve a relationship, and effects on esteem, self-worth, and feelings of attractiveness. Sex and CAI may be valuable precisely because the benefits they bring may not be easily expressed in monetary terms.

Interestingly, age was a significant between-subjects predictor of choosing CAI over earning money, such that older participants expressed a significant preference for CAI. This finding may suggest a true age-dependent effect or implicate a possible confound in that older individuals tend to have more money and resources than younger individuals (U.S. Bureau of Labor Statistics, 2021), so that the opportunity costs of choosing CAI over money may have been less prescient for them. Alternatively, it may be that older individuals have fewer opportunities to engage in CAI, which could increase the value of CAI through scarcity.

Secondary Multilevel Analyses

The secondary multilevel analyses examined hypotheses four and five, which predicted that more attractive partners (hypothesis four) and greater sexual arousal (hypothesis five) would increase the effects of intoxication on the discounting and monetary equivalence tasks used in this study. To examine interactions between alcohol use, partner attractiveness, and sexual arousal, the primary multilevel analyses described above were modified to include interaction terms between alcohol use and (1) partner attractiveness, and (2) sexual arousal. Partner attractiveness was measured by participant

ratings of the attractiveness of the potential partner shown prior to each task iteration and sexual arousal was calculated as the mean value of two questions asked during the evening surveys: “how sexually aroused are you right now?” and “how horny are you right now?”. Within-subjects interaction terms were included in the multilevel models at level one while the remaining within- and between-subjects components were included at level one and level two, respectively.

Past research has suggested that partner attractiveness can affect perceptions of sexual risk. The direction of this effect, however, has not always been consistent between studies (Sarno & Mohr, 2020). A number of studies among heterosexual individuals and MSM have found more attractive partners to be associated with reduced perceptions of risk (Agocha & Cooper, 1999; Blanton & Gerrard, 1997; Gold & Skinner, 1992) and increased likelihood of engaging in condomless intercourse (Agocha & Cooper, 1999; Eleftheriou et al., 2016; Kruse & Fromme, 2005; Lambert et al., 2011; Wongsomboon & Robles, 2017). At the same time, other studies have found no relationship between attractiveness and risk (Epstein et al., 2007; Renner et al., 2012) or a positive association between the two factors, suggesting that more attractive partners are associated with greater sexual risk (Dijkstra et al., 2000; Gold & Skinner, 1996; Lennon & Kenny, 2013), perhaps due to assumptions that more attractive individuals tend to have more opportunities to engage in sexual behavior (Dijkstra et al., 2000; Gold & Skinner, 1996). In the condom discounting literature, studies using the sexual delay discounting task (M. W. Johnson & Bruner, 2012) have consistently found that condom discounting becomes more likely with partners judged as more desirable (Herrmann et al., 2014; M.

W. Johnson et al., 2015; M. W. Johnson & Bruner, 2012, 2013; Wongsomboon & Robles, 2017)

Similarly, past research has indicated that sexual arousal is a potent predictor of risky sexual behavior, especially when combined with alcohol consumption (Ebel-Lam et al., 2009; George et al., 2009; Maisto et al., 2012; Wray, Celio, et al., 2019). Laboratory studies have found associations between higher levels of sexual arousal and greater intentions to engage in condomless sex. These findings have extended across populations, including among MSM (Buckheit et al., 2019; Maisto et al., 2012; Shuper et al., 2017; Shuper & Fisher, 2008) and men who have sex with women (Davis et al., 2009; Ebel-Lam et al., 2009; George et al., 2009; MacDonald, Fong, et al., 2000; Norris et al., 2009; Wray, Celio, et al., 2019; Wray et al., 2015).

Examination of the effects of partner attractiveness and sexual arousal on the effort discounting task yielded results that were not supportive of the secondary hypotheses described above. There was no within-subjects effect of partner attractiveness on AOC in the effort discounting task, nor a within-subjects interaction effect of alcohol consumption and partner attractiveness. This was contrary to the hypothesis that partner attractiveness would interact with alcohol consumption to result in greater AOC. Alcohol consumption remained a significant within-subjects predictor of AOC in the model, both when measured as any alcohol consumption and in terms of standard drinks. These results add to the complexity of the research literature described above and suggest that more investigation of this topic is needed to better understand the

ways in which partner attractiveness affects sexual decision-making, both with and without concurrent alcohol consumption.

Sexual arousal in the effort discounting task told a similar story. When sexual arousal was added to the effort discounting models, it was not a significant predictor of AOC, either individually or in interaction with alcohol use. Like with partner attractiveness, this result was contrary to the hypothesis that sexual arousal would interact with alcohol consumption to predict reduced likelihood of expending effort to obtain a condom prior to sex. While interactions between alcohol use and sexual arousal have been more frequently studied in heterosexual (Davis et al., 2007, 2009; Ebel-Lam et al., 2009; George et al., 2009; MacDonald, Fong, et al., 2000; Prause et al., 2011; Simons et al., 2016; Wray et al., 2015) than in MSM populations (Buckheit et al., 2019; Maisto et al., 2012, 2022; Wray, Celio, et al., 2019; Wray et al., 2021), findings have generally suggested that alcohol use interacts with sexual arousal to predict increased intentions to engage in risky sexual behavior (including condomless sex) and reduce the effectiveness of condom negotiation skills. Given that evidence base, it is somewhat surprising that there was no direct effect of sexual arousal on willingness to expend effort to obtain condoms, nor an interaction effect between alcohol consumption and sexual arousal, though it may be that the sample of 51 MSM used in this study lacked power to discern those effects.

A different pattern of results was observed for the condom discounting task. As suggested by previously-published literature on the original Johnson and Bruner (2012) sexual delay discounting task (e.g., Herrmann et al., 2014, 2015; M. W. Johnson &

Bruner, 2012, 2013; Wongsomboon & Robles, 2017), and more general findings that partner attractiveness decreases intentions to use condoms and increases the likelihood of condomless intercourse (Agocha & Cooper, 1999; Blanton & Gerrard, 1997; Eleftheriou et al., 2016; Gold & Skinner, 1992; Kruse & Fromme, 2005; Lambert et al., 2011; Sarno & Mohr, 2020), partner attractiveness did emerge as a significant within-subjects predictor of increased condom discounting in the secondary analyses. Contrary to hypotheses, however, alcohol use, whether measured as any consumption or in terms of standard drinks, failed to significantly predict AOC at either the within-subjects or between-subjects levels and did not have significant interaction effects with partner attractiveness. This finding of a significant within-subjects effect of partner attractiveness on AOC has important implications for research into mechanisms of sexual risk that do not involve alcohol: not only does it replicate the findings described above (Agocha & Cooper, 1999; Blanton & Gerrard, 1997; Eleftheriou et al., 2016; Gold & Skinner, 1992; Kruse & Fromme, 2005; Lambert et al., 2011; Sarno & Mohr, 2020), but it implies that risk reduction strategies may benefit from (1) providing education about the effect of partner attractiveness on sexual decision-making, and (2) offering advice on how to maintain motivation for condom use when partner attractiveness is high. The results also suggest that it may be important to conduct research into the mechanisms of the relationship between partner attractiveness and condom discounting. For example, does reduced willingness to wait for sex with a condom with more attractive partners reflect a greater value for CAI with more attractive partners? Or is it potentially rooted in fear that the opportunity to have sex with the more attractive partner might disappear if

waiting prior to intercourse is required? Answers to these questions will provide insight into the reason(s) why greater partner attractiveness predicts reduced willingness to wait for condom-protected sex.

Unlike partner attractiveness, sexual arousal was not a significant predictor of AOC for the condom discounting task and did not interact with alcohol when alcohol was modeled dichotomously, as any consumption versus no consumption. There was a crossover interaction effect, however, when alcohol was measured in number of standard drinks consumed prior to completing the task. This within-subjects interaction was significant only when participants consumed more than 1.75 standard drinks above average: at that level of drinking, participants with high levels of sexual arousal maintained high levels of AOC, but those with low levels of sexual arousal saw their AOC scores drop precipitously. This interaction effect has important implications for the conceptualization of the relationship between alcohol use, sexual arousal, and motivation for condom-protected sex, especially as the effects of the two measured variables were significant only during their interaction. It suggests that high levels of sexual arousal contribute to reduced likelihood of waiting to have condom-protected sex regardless of the quantity of alcohol consumed, but that drinking when sexual arousal is low makes it much more likely that a participant will wait to have sex with a condom rather than immediately without a condom. In this sense, the results suggest that drinking during periods of low sexual arousal may have a protective effect in reducing the likelihood of risky sexual behavior.

In the secondary multilevel analyses of the monetary equivalence task, partner attractiveness also emerged as a significant within-subjects predictor of increased AUC. That is, as partner attractiveness increased, participants were more likely to choose to have an episode of CAI rather than earn money. This effect did not interact with alcohol consumption, however. The finding of a significant within-subjects effect of partner attractiveness on AUC offers insight into the concept of value as it is applied to episodes of CAI, indicating that the opportunity to have sex with a partner of higher subjective attractiveness increased the value of CAI relative to earning money in ways that alcohol did not. As with the results from the condom discounting task, this finding has important implications for prevention efforts, which may benefit from providing information about the importance of utilizing safer sexual practices with participants who are perceived to be especially attractive or desirable, as well as for future research on the mechanisms underlying this causal relationship.

Lastly, similar to findings from analyses with the other two tasks, no within-subjects effect of sexual arousal on monetary equivalence task outcomes was observed, nor was there an interaction effect between sexual arousal and alcohol consumption. This finding was unexpected given the extent of past research on MSM and heterosexual individuals that has detected relationships between sexual arousal and the incidence of risky sexual behavior (Buckheit et al., 2019; Davis et al., 2007, 2009; Ebel-Lam et al., 2009; George et al., 2009; Maisto et al., 2012, 2022; Prause et al., 2011; Simons et al., 2016; Wray, Celio, et al., 2019; Wray et al., 2015, 2021). However, much of that past research, especially the studies that have focused on MSM, have drawn conclusions from

questionnaire measures of intentions related to risky sexual behavior. Those findings cannot be directly compared to outcomes from the monetary equivalence task, which did not investigate intentions to engage in risky sexual behavior. Instead, the instructions for the monetary equivalence task specified that participants should indicate their likelihood of choosing between an episode of riskless CAI, without any potential for HIV or STI infection, and the possibility of earning increasing amounts of money. Future research that examines the effect of sexual arousal on the value of or motivation for CAI could provide more insight into the findings from the present study.

The final set of secondary multilevel analyses examined the within-subjects effect of heavy drinking on outcomes from the three tasks. While results were in the hypothesized direction (e.g., that heavy drinking would increase AOC and AUC), the results were not significant. Heavy drinking was defined as having five or more drinks prior to task completion, to accord with definition of heavy-drinking (or binge-drinking) episodes for men (Wechsler et al., 2002). In past research (Bryant et al., 2010; Scott-Sheldon et al., 2016; Shuper et al., 2017), heavy drinking has been associated with increased likelihood of sexual risk behavior, including increased incidence of CAI among MSM (Hess et al., 2015), so it was somewhat surprising that these secondary analyses of heavy drinking did not yield significant results. However, it may be that the incidence of heavy drinking during the study (consumption of five or more drinks was reported on 118 out of a total of 1658 [7.1%] evening surveys returned by study participants) was too low to allow detection of significant effects.

Point-by-Point Analyses

The point-by-point analyses, which built upon past research that examined differences at the zero-delay point only (Berry et al., 2022; Dariotis & Johnson, 2015; Herrmann et al., 2014, 2015; M. W. Johnson & Bruner, 2012; P. S. Johnson et al., 2016; Wongsomboon & Robles, 2017), revealed interesting patterns of results that would have been obscured by analyzing full AOC and AUC values only. For the effort discounting task, in which any alcohol consumption predicted significantly greater AOC using unstandardized likelihood values, the point-by-point analyses for any alcohol consumption showed that within-subjects, the likelihood of expending effort was significantly reduced for all discounting points except for the first (the zero-delay point) and last (120 minutes of effort). The results when alcohol consumption was measured in terms of standard drinks were different, with significant alcohol-related differences observed at only the 10- and 60-minute discounting points. This is similar to past results from alcohol- and drug-administration studies of Johnson and Bruner's (2012) sexual delay discounting task, which did not find significant alcohol (P. S. Johnson et al., 2016), cocaine (M. W. Johnson et al., 2017), or methamphetamine (Berry et al., 2022) effects on observed differences at the zero-delay point.

For the condom discounting task, there were no significant within-subjects effects of alcohol consumption at any of the discounting points. This is consistent with the overall lack of alcohol effects observed in the primary and secondary analyses. Partner attractiveness, however, did significantly contribute to within-subjects differences at the zero-delay point and delays equal to or longer than two hours. This means that for

shorter delays, participants did not have a preference between immediate sex without a condom or delayed sex with a condom for more attractive partners, but as the delay period increased, preference shifted to immediate sex without a condom for more attractive partners. This may reflect worry that the potential partner will be willing to wait for shorter but not longer periods to have condom-protected sex with the participant; alternatively, it may imply that participants judged more attractive partners as less likely to have HIV or an STI, which is consistent with some past research on the effects of partner attractiveness (Agocha & Cooper, 1999; Blanton & Gerrard, 1997; Gold & Skinner, 1992; Schmälzle et al., 2012). As noted above, more research into the mechanisms by which partner attractiveness exerts its impact on sexual risk behavior among MSM is warranted, with the results from the point-by-point analyses suggesting that the potential for sex with more attractive partners may disincentivize waiting to have sex with a condom.

A similar pattern of results emerged for the monetary equivalence task, for which greater partner attractiveness predicted significant within-subjects increases in the likelihood of choosing to have an episode of CAI rather than earn increasing amounts of money at every equivalence point in the task. This suggests that partner attractiveness is a more consistent predictor of increased value/motivation for CAI than it is for reduced willingness to wait to have sex with a condom. This may imply that mechanisms of sexual risk related to partner attractiveness operate through increasing the value of CAI instead of via fear that a more attractive partner might be unwilling to wait through increasingly lengthy delay periods to have sex with the participant. By finding a

significant effect of partner attractiveness at every equivalence point, from $1 to $1000, the point-by-point analyses also indicated that having sex with a more attractive partner was worth the opportunity costs of failing to earn $1000, suggesting that having sex with attractive partners was worth something beyond that which money can buy. This may be related to findings that external markings of beauty or attractiveness can imply the existence of other positive characteristics in potential partners (e.g., the "what is beautiful is good" stereotype; Dion et al., 1972; Little et al., 2011), which can increase desire to build relationships with more attractive individuals (Lemay et al., 2010).

Implications for Risk Reduction Strategies

The results of this study have several implications for HIV risk reduction strategies for MSM, especially MSM who are heavy drinkers or binge drinkers. A recent review (Palfai & Luehring-Jones, 2021) concluded that interventions to reduce HIV behavior have rarely also targeted problematic or harmful patterns of drinking despite the close relationship between alcohol use and increased likelihood of risky sexual behaviors in MSM populations. Those few interventions that do exist, for both MSM and heterosexual populations, (e.g., Celio et al., 2017; Dermen & Thomas, 2011; Edelman et al., 2012; Langhorst et al., 2012; Lewis et al., 2014; Peragallo et al., 2012; Wray, Kahler, et al., 2019) tend to employ an additive approach, where motivationally-based strategies for reducing drinking (e.g., motivational interviewing [MI]; Miller & Rollnick, 2002, 2013) are provided alongside education and instruction on ways to increase safer sexual behavior. There is initial evidence that such interventions are more effective than control conditions, which have included brief advice, counseling following HIV testing, and no

intervention (Celio et al., 2017; Dermen & Thomas, 2011; Monti et al., 2016; Wray, Kahler, et al., 2019). The emphasis on motivational interventions in this nascent field of risk reduction approaches is likely based on the centrality of motivation to a number of theories of behavior change that have been applied to HIV prevention (Albarracín et al., 2001; H. H. Fisher et al., 2011), including the Information-Motivation-Behavior (IMB) model (J. D. Fisher et al., 1996; J. D. Fisher & Fisher, 1992) and the Theory of Planned Behavior (TPB) (Ajzen, 1991; Ajzen & Madden, 1986). Both the IMB model and TPB posit that motivation to engage in certain behaviors is one of the primary predictors of behavioral outcomes, so that increases in motivation for safer sexual behavior should result in more consistent condom use while reductions in motivation for condom use should lead to more risk during sexual encounters. (J. D. Fisher et al., 2002; W. A. Fisher et al., 2014; Kalichman et al., 2008).

The results of this study provide evidence that alcohol (in the effort discounting task) and partner attractiveness (in the condom discounting and monetary equivalence tasks) can negatively impact motivation for condom use and increase the perceived value of episodes of CAI. Following on the IMB model and TPB, this suggests that alcohol consumption and heightened levels of partner attractiveness will also reduce intent to use condoms during sexual encounters, leading to increased risk of HIV seroconversion and STI transmission. One primary implication from these results is that non-condom methods of HIV prevention should be prioritized for MSM, so that shifting motivation for condom use will be less impactful on HIV risk during sex. PrEP for HIV (a daily pill containing a combination of antiviral medications) has been shown to have near 100%

efficacy in preventing HIV infection when taken as directed (Chen et al., 2016; Luehring-Jones et al., 2019; Molina et al., 2015), and promising new research suggests that long-acting PrEP could be administered by relatively infrequent injection, which would reduce the burden of taking a daily pill (Beymer et al., 2019; Clement et al., 2020).

In addition to promoting PrEP use as a non-condom form of HIV prevention, the results of this study also suggest that existing interventions may benefit from modifications to provide education on how (1) alcohol consumption decreases motivation to expend effort to procure condoms, and (2) increased partner attractiveness decreases motivation to wait for condom-protected sex and increases the value of CAI. Interventions that can help individuals maintain motivation for condom use during periods of alcohol consumption or during sexual encounters with particularly attractive partners will also likely prove beneficial to efforts to reduce HIV transmission. Interventions that use MI frameworks may be particularly valuable for individuals who experience motivational deficits in these situations. Of course, how interventions will accomplish this difficult objective remains an open question: it is easy to say that interventions should focus on maintaining motivation when MSM drink or have sex with attractive partners, but harder to say how that might be accomplished. Still, the results of this study provide strong evidence that interventions that focus efforts on maintaining and improving motivation for condom use will likely be an important component of HIV prevention efforts in the future.

Strengths and Limitations

Strengths

This study had many strengths, in terms of the sample of participants recruited, the novelty of its tasks and methods of task administration, and its ability to discern (1) causal relationships between contextual factors related to sexual encounters, and (2) increases in sexual risk using non-experimental methods outside of the laboratory. In terms of participants, the sample of MSM recruited for this study represented individuals at heightened risk for negative sexual outcomes (including HIV infection) due to their histories of engaging in risky sexual behavior. All participants reported inconsistent condom use during sexual encounters (e.g., at least one episode of CAI during the three months prior to study enrollment) and were not taking PrEP to reduce their risk of HIV infection during CAI. They also reported engagement in harmful patterns of drinking, including at least one heavy-drinking episode (the consumption of five or more drinks in a single drinking session; Wechsler et al., 2002) during the month prior to study enrollment. AUDIT scores obtained during administration of the baseline questionnaires showed that most participants reported harmful or hazardous levels of drinking (i.e., AUDIT scores of eight or more). The study's participants, therefore, represented a population of MSM who are more likely than others to contract HIV and other STIs because of their drinking habits and inconsistent approach to safer sexual practices. MSM who report consistent PrEP use, for instance, can engage in CAI with partners of unknown or positive HIV status without fear that they will contract HIV (Grant et al., 2010; Luehring-Jones et al., 2019; Molina et al., 2015), but the men who participated in

this study reported engaging in CAI without the benefit of biomedical or other strategies to prevent HIV seroconversion. If the United States is to meet its goal of eliminating HIV transmission by 2030 (Fauci et al., 2019; Katz & Jha, 2019), it is imperative that intervention efforts be focused on MSM with risk factors similar to those who participated in this study because it is among those MSM that HIV is likely to continue to spread.

Second, this study piloted the novel effort discounting and monetary equivalence tasks and demonstrated that task outcomes from both were significantly correlated with existing measures of sexual risk, including sexual risk behavior and self-regulatory cognitions related to condom use. Outcomes from multilevel analyses showed that alcohol consumption had a significant within-subjects effect on the amount effort that participants were willing to expend to procure a condom prior to having sex, providing evidence that alcohol can negatively impact motivation for condom use and suggesting that alcohol-induced changes in motivation for condom use may be a mechanism of alcohol-induced sexual risk among MSM. Results from the monetary equivalence task demonstrated that the possibility of having sex with more attractive partners significantly increased the value of an episode of CAI for the MSM in the study, a result that replicated earlier findings and provides evidence that partner attractiveness is also a significant mechanism of sexual risk behavior in this population. These results were similar to those from the condom discounting task, which also identified partner attractiveness as a significant predictor of increased sexual risk via increased likelihood of having sex immediately without a condom versus waiting to have sex with a condom

after a period of delay. While hypotheses about the effects of alcohol on the condom discounting and monetary equivalence task were not supported, findings about the significant effects of partner attractiveness on sexual decision-making processes have important implications for research into risk perception and the development of interventions to reduce sexual risk.

Third, this study demonstrated, for the first time, that discounting tasks can be administered outside of the laboratory as part of an EMA study design, so that the real-time effects of contextual variables on discounting rates can be observed. Participants not only completed most of the tasks assigned to them, but they did so in ways that yielded orderly, systematic discounting data similar to data collected during past questionnaire and laboratory-based studies. The present study has the potential to inform and influence future research in the burgeoning field of mobile assessment, which has been used to collect data in psychological, psychiatric, and medical research (e.g., Kampshoff et al., 2019; G. Liu et al., 2019; Moore et al., 2017, 2020).

Finally, this study demonstrated that non-experimental, repeated-measures designs can provide insight into causal alcohol effects that occur outside of the laboratory (Bolger & Laurenceau, 2013; T. D. Little, 2013). While carefully controlled and blinded laboratory-based experimental research remains the gold standard for establishing causal effects (e.g., Holland, 1986), such research is often limited in its ability to discern within-subjects processes because individual participants in experimental research cannot serve as their own controls (Bolger & Laurenceau, 2013) and thus within-subjects changes cannot be observed. In the present study, however, the use of intensive longitudinal

methods within an EMA framework allowed for the repeated collection of discounting and equivalence data from participants across multiple conditions of alcohol consumption, partner attractiveness, and sexual arousal. Given the ability of EMA research to establish temporal relationships between contextual factors and discounting/monetary equivalence task outcomes, it was possible to move beyond correlation and into the realm of causal inference. These findings demonstrate the power of EMA research to move investigation of causal effects outside of the laboratory and into the natural environment to observe mechanisms of sexual decision-making as they influence sexual discounting and monetary equivalence outcomes.

Limitations

Even with the many strengths identified above, several limitations of the present study should be considered when interpreting its results. First, the sample of MSM enrolled in this study was relatively small ($N = 56$) and included fewer individuals than other recent studies that used EMA methods to study sexual decision-making among MSM (e.g., Maisto et al., 2022; Wray et al., 2021; Wray, Luo, et al., 2019). Future studies should seek to replicate and extend the results reported herein with larger samples across lengthier EMA periods. Doing so would improve the power of future studies to detect results, especially for hypothesized relationships that were not borne out in the data collected for this study. It may be that alcohol does have significant within-subjects effects on outcomes for the condom discounting and monetary equivalence tasks but that this study did not have the power to observe them.

Second, this study had higher-than-average rates of non-systematic data collected during task administration. A recent meta-analysis of sexual discounting tasks reported that across 26 studies, an average of 12.6% of trials were eliminated as non-systematic (M. W. Johnson et al., 2021). For the effort discounting task, 8.8% of trials were non-systematic per criteria one and two and 16.1% of trials were zero trials, which meant that a total of 25.0% of trials were excluded from the primary and secondary analyses. For the condom discounting task, which was the task most related to previously published sexual delay discounting tasks, 25.8% of trials were nonsystematic per criteria one and two and 13.4% of trials were zero trials, resulting in 39.2% of trials excluded from the primary and secondary analyses. Finally, for the monetary equivalence task, 10.6% of trials were nonsystematic per criteria one and two while 25.1% of trials were zero trials, leading to 35.7% of trials being excluded from the primary and secondary analyses. These higher-than-average rates of trial exclusion may have been a product of the EMA style of data collection used in this study: repeated administration of the tasks may have induced boredom or a sense of familiarity with the tasks that could have induced participants to pay less attention when responding, potentially increasing the rate of trials identified as nonsystematic per the criteria used in this study.

Finally, another limitation of this study concerns the monetary equivalence task. The task did not include an actual zero-delay point and so trial data were standardized for the primary and secondary analyses based on responses to the first equivalence point, which asked participants to indicate the likelihood that they would choose to have an episode of CAI rather than earn $1. The reason for this departure of practice from the

other two tasks was due to potential confusion that could have resulted from inclusion of a zero-delay question. While the condom discounting task asked participants to consider whether they would prefer to have immediate CAI or immediate sex with a condom for its zero-delay question, a similar question for the monetary equivalence task would have been nonsensical (e.g., "what is the likelihood that you would choose to have an episode of CAI rather than earn $0?") and may have confused participants. As a result, it was decided during task development to start the task with the $1 equivalence point rather than a $0 equivalence point. This difference in standardization practices between the monetary equivalence task and the effort and condom discounting tasks should be kept in mind while considering the results of that task.

Conclusions

Considered together, the results of this study support several conclusions about the within-subjects effect of alcohol on motivation for condom use during sexual encounters among MSM. First, during primary analyses when alcohol was as the sole contextual predictor of task outcomes, alcohol consumption significantly predicted increased AOC on a within-subjects basis for the effort discounting task only. This result suggests that alcohol consumption impairs willingness to expend effort to obtain a condom but does not support the view that alcohol may impact willingness to wait to have sex with a condom (as in the condom discounting task) or increase the value of an episode of CAI relative to earning money (as in the monetary equivalence task). This pattern of findings implies that alcohol consumption impacts the likelihood of behavior that requires active effort (e.g., leaving the house, driving to a store, and spending money

on condoms) but does not significantly impact more passive processes, like waiting to have sex with a condom or deciding how much an episode of CAI is worth. In secondary analyses, partner attractiveness emerged as a significant predictor of AOC for the condom discounting task and of AUC for the monetary equivalence task, whereas sexual arousal did not predict AOC or AUC in any of the three tasks. The only task with a significant interaction effect was the condom discounting task, in which AOC was predicted by a crossover interaction between alcohol consumption and sexual arousal that led to higher AOC scores for heavy-drinking individuals with high levels of sexual arousal and lower AOC scores for heavy-drinking individuals with low levels of sexual arousal. These findings point to the impact that partner characteristics can have on decisions related to sexual behavior. The possibility of having sex with more attractive partners increased the value of CAI and caused participants to become significantly less likely to wait to have sex with a condom, indicating that motivation for condom use was negatively impacted when potential partners were especially desirable.

These findings have important implications for intervention development aimed at reducing sexual risk among MSM who drink. They suggest that (1) biomedical approaches like PrEP that provide non-condom-based protection against HIV infection should be considered for individuals with greater motivational deficits following drinking or when considering sex with more attractive partners, and (2) interventions may benefit from including components that enhance motivation for condom acquisition and use and preserve (if possible) that motivation during periods of alcohol consumption or when partners are especially attractive. Finally, they suggest that future research may benefit

from continued use of the tasks piloted in this study to gather real-world data about contextual factors that affect processes of sexual decision-making among MSM. Such data will likely be of crucial importance to the development of more effective interventions to reduce HIV transmission in this at-risk population.

Tables

Table 1. Demographic Characteristics

	Full sample (N=55)		Included Participants (N=51)	
Measure	Mean	SD	Mean	SD
Age (years)	32.6	8.5	31.9	8.0
Annual Income	$41,940	$30,626	$42,931	$28,564
Race	*n*	*%*	*n*	*%*
Asian	2	3.6	2	3.9
Black or African American	6	10.9	6	11.8
Other	7	18.2	7	13.7
Unreported	1	1.8	1	2.0
White	39	70.9	35	68.6
Ethnicity				
Non-Hispanic	45	81.8	41	80.4
Hispanic	10	18.2	10	19.6
Marital Status				
Never married	48	87.3	45	88.2
Married	2	3.6	2	3.9
Divorced	4	7.3	4	7.8
Widowed	1	1.8	0	0
Relationship Status				
Not in a relationship	40	72.7	36	70.6
In a relationship	15	27.3	15	29.4
With a man	11	20.0	11	21.6
With more than one man	4	7.3	4	7.8
Kinsey Scale	Exclusively Homosexual 41 (74.5%)	Not Exclusively Homosexual 14 (25.5%)	Exclusively Homosexual 38 (74.5%)	Not Exclusively Homosexual 13 (25.5%)

Table 2. Correlations Between Mean Task Outcomes and Sexual Behavior

	1.	2.	3.	4.	5.	6.	7.	8.
1. Mean effort discounting AOC		.793**	.010	.177	.163	.162	.160	-.411**
2. Mean condom discounting AOC			-.057	.186	.199	.215	.133	-.265
3. Mean monetary equivalence AUC				-.073	.104	.220	.055	-.043
4. Lifetime male sexual partners					.662**	.611**	.276	-.030
5. Past year male sexual partners						.505**	.203	-.126
6. Past three-month male sexual partners							.406**	-.089
7. Past three-month incidence of CAI								-.281*
8. Frequency of condom use								

N = 51. AOC = area over the curve. AUC = area under the curve. Sexual behavior outcomes were taken from the Sexual Behavior Questionnaire (SBQ). * Correlation is significant at $p < .05$. ** Correlation is significant at $p < .01$.

Table 3. Correlations Between Mean Task Outcomes and Self-Regulatory Cognitions

	1.	2.	3.	4.	5.	6.	7.	8.
1. Mean effort discounting AOC		.793**	.010	-.541**	-.130	-.482**	-.468**	-.501**
2. Mean condom discounting AOC			-.057	-.367*	-.193	-.473**	-.409**	-.404**
3. Mean monetary equivalence AUC				-.363*	-.362*	-.355*	-.395**	-.417**
4. GSAB condom value					.628**	.745**	.759**	.805**
5. GSAB condom self-efficacy						.519**	.562**	.562**
6. GSAB condom monitoring							.910**	.708**
7. GSAB condom planning								.749**
8. Condom use intentions								
9. MCAS pleasure subscale								
10. MCAS identity stigma subscale								
11. MCAS embarrassment subscale								

N = 51. AOC = area over the curve. AUC = area under the curve. GSAB = Goal Systems Assessment Battery. MCAS = UCLA Multidimensional Condom Attitudes Scale. Embarrassment subscale = MCAS embarrassment about negotiation and use subscale. * Correlation is significant at $p < .05$. ** Correlation is significant at $p < .01$.

Table 3, continued.

	9.	10.	11.
1. Mean effort discounting AOC	-.495**	-.130	-.194
2. Mean condom discounting AOC	-.482**	-.070	-.189
3. Mean monetary equivalence AUC	-.277	-.549**	-.156
4. GSAB condom value	.547**	.384**	.188
5. GSAB condom self-efficacy	.385**	.454**	.381**
6. GSAB condom monitoring	.566**	.337*	.195
7. GSAB condom planning	.563**	.365*	.245
8. Condom use intentions	.596**	.362**	.362**
9. MCAS pleasure subscale		.352**	.447**
10. MCAS identity stigma subscale			.328*
11. MCAS embarrassment subscale			

Table 4. Correlations Between Mean Task Outcomes and Self-Control Measures

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Mean effort discounting AOC		.793**	.010	-.101	-.049	.042	.037	.067	-.011	-.005	.078
2. Mean condom discounting AOC			-.057	.061	.030	.055	.247	.119	.012	.104	-.005
3. Mean monetary equivalence AUC				-.103	.080	-.098	.085	.153	-.234	-.199	-.152
4. S-UPPS-P negative urgency					.449**	-.030	.171	.577**	-.389**	-.244	-.384**
5. S-UPPS-P positive urgency						.191	.238	.426**	-.396**	-.224	-.466**
6. S-UPPS-P sensation seeking							-.259	-.032	-.070	-.120	.030
7. S-UPPS-P lack of perseverance								.356*	-.262	-.204	-.343*
8. S-UPPS-P lack of premeditation									-.297*	-.202	-.406**
9. BSCS total self-control										.848**	.819**
10. BSCS inhibitory self-control											.550**
11. BSCS initiatory self-control											

N = 51. AOC = area over the curve. AUC = area under the curve. S-UPPS-P = Short Urgency, Premeditation, Perseverance, Sensation Seeking, and Positive Urgency Scale. BSCS = Brief Self-Control Scale. * Correlation is significant at $p < .05$. ** Correlation is significant at $p < .01$.

Table 5. Correlations Between Mean Task Outcomes and SRS Outcomes

	1.	2.	3.	4.	5.	6.	7.	8.
1. Mean effort discounting AOC		.793**	.010	.321*	.109	.153	-.122	.068
2. Mean condom discounting AOC			-.057	.363*	.216	.137	-.093	.101
3. Mean monetary equivalence AUC				.075	.130	-.057	.049	.283
4. SRS uncommitted partners sub.					.366**	.512**	.141	.359*
5. SRS risky sexual acts subscale						.270	.334*	.579**
6. SRS impulsive behavior subscale							.276*	.108
7. SRS intentions for risky sex sub.								.290*
8. SRS anal sex subscale								

N = 51. AOC = area over the curve. AUC = area under the curve. SRS = Sexual Risk Scale. Sub. = subscale. * Correlation is significant at $p < .05$. ** Correlation is significant at $p < .01$.

Table 6. Correlations Between Mean Task Outcomes and Condom Purchase Task Outcomes

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Mean effort discounting AOC		.793**	.010	.116	.111	-.119	.232	-.033	.177	.055	-.095
2. Mean condom discounting AOC			-.057	-.065	-.067	-.112	.001	-.075	-.099	.064	-.028
3. Mean monetary equivalence AUC				-.163	-.168	-.066	.298	.211	.247	-.065	.434
4. Observed demand intensity					.998**	.174	-.088	-.459**	.146	-.035	-.342
5. Derived demand intensity						.163	-.110	-.476**	.114	-.064	-.354
6. Derived demand elasticity							-.307*	-.368*	-.074	-.125	-.091
7. Derived maximum expenditure								.700**	.884**	.404**	.372
8. Derived price at max. expenditure									.511**	.461**	.361
9. Empirical maximum expenditure										.525**	.353
10. Empirical price at max. expend.											.904**
11. Breakpoint											

N = 51. AOC = area over the curve. AUC = area under the curve. Max. = maximum. Expend. = expenditure. * Correlation is significant at $p < .05$. ** Correlation is significant at $p < .01$.

Table 7. Effort Discounting Task: Effect of Any Drinking on AOC

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Any alcohol	5.259	1.827	.004	1.679	8.839
Elapsed day in the study	-0.210	0.140	.135	-0.484	0.065
Day of the week					
Monday	-4.308	3.216	.180	-10.612	1.996
Tuesday	-4.474	2.916	.125	-10.188	1.241
Wednesday	3.248	2.523	.198	-1.697	8.193
Thursday	-0.480	2.446	.845	-5.274	4.315
Friday	0.693	2.925	.813	-5.040	6.425
Saturday	-4.160	2.770	.133	-9.590	1.270
Between-person					
Any alcohol	24.018	20.827	.249	-16.803	64.838
Age	-0.080	0.571	.888	-1.200	1.039

N (task iterations) = 633, *N* (persons) = 49. The output listed above is unstandardized. Any alcohol was coded as 0 = no alcohol consumed, 1 = alcohol consumed. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for any alcohol and elapsed study day were centered at the person mean. All between-person variables were centered at the grand mean. AOC = area over the curve.

Table 8. Effort Discounting Task: Effect of Standard Drinks on AOC

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Standard drinks	1.121	0.428	.009	0.282	1.960
Elapsed day in the study	-0.299	0141	.106	-0.506	0.048
Day of the week					
Monday	-4.494	3.285	.171	-10.932	1.944
Tuesday	-4.624	2.959	.118	-10.423	1.176
Wednesday	3.193	2.537	.208	-1.778	8.165
Thursday	-0.375	2.502	.881	-5.280	4.529
Friday	0.359	2.997	.905	-5.515	6.234
Saturday	-4.342	2.714	.110	-9.663	0.978
Between-person					
Standard drinks	2.641	4.845	.586	-6.855	12.136
Age	0.013	0.612	.983	-1.187	1.212

N (task iterations) = 633, *N* (persons) = 49. The output listed above is unstandardized. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for standard drinks and elapsed study day were centered at the person mean. All between-person variables were centered at the grand mean. AOC = area over the curve.

Table 9. Condom Discounting Task: Effect of Any Drinking on AOC

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Any alcohol	-3.467	6.125	.571	-15.472	8.537
Elapsed day in the study	-0.364	0.392	.353	-1.133	0.404
Day of the week					
Monday	-21.444	7.847	.006	-36.824	-6.064
Tuesday	-9.308	7.540	.217	-24.086	5.470
Wednesday	1.286	5.816	.825	-10.113	12.684
Thursday	2.291	7.533	.761	-12.474	17.055
Friday	3.329	7.155	.642	-10.695	17.353
Saturday	7.376	7.575	.330	-7.471	22.222
Between-person					
Any alcohol	44.969	29.933	.133	-13.700	103.638
Age	-0.378	0.878	.667	-2.098	1.343

N (task iterations) = 538, *N* (persons) = 46. The output listed above is unstandardized. Any alcohol was coded as 0 = no alcohol consumed, 1 = alcohol consumed. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for any alcohol and elapsed study day were centered at the person mean. All between-person variables were centered at the grand mean. AOC = area over the curve.

Table 10. Condom Discounting Task: Effect of Standard Drinks on AOC

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Standard drinks	0.443	1.339	.741	-2.182	3.068
Elapsed day in the study	-0.336	0.384	.382	-1.089	0.417
Day of the week					
Monday	-20.818	7.541	.006	-35.599	6.038
Tuesday	-8.770	7.535	.244	-23.538	5.997
Wednesday	1.962	5.728	.732	-9.265	13.190
Thursday	2.668	7.646	.727	-12.318	17.653
Friday	2.653	7.427	.721	-11.905	17.211
Saturday	7.191	7.852	.360	-8.199	22.581
Between-person					
Standard drinks	1.555	7.196	.829	-12.550	15.660
Age	-0.133	0.992	.893	-2.077	1.812

N (task iterations) = 538, *N* (persons) = 46. The output listed above is unstandardized. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for standard drinks and elapsed study day were centered at the person mean. All between-person variables were centered at the grand mean. AOC = area over the curve.

Table 11. Monetary Equivalence Task: Effect of Any Alcohol on AUC

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Any alcohol	34.287	19.749	.083	-4.421	72.996
Elapsed day in the study	-0.847	0.965	.380	-2.737	1.044
Day of the week					
Monday	2.337	15.771	.882	-28.574	33.249
Tuesday	-3.581	20.825	.863	-44.398	37.235
Wednesday	-25.725	23.086	.265	-70.972	19.523
Thursday	9.434	20.633	.647	-31.006	49.875
Friday	8.242	30.442	.787	-51.423	67.908
Saturday	2.497	21.951	.909	-40.527	45.520
Between-person					
Any alcohol	-3.797	138.247	.978	-274.762	267.168
Age	7.582	2.634	.004	2.420	12.744

N (task iterations) = 531, *N* (persons) = 47. The output listed above is unstandardized. Any alcohol was coded as 0 = no alcohol consumed, 1 = alcohol consumed. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for any alcohol and elapsed study day were centered at the person mean. All between-person variables were centered at the grand mean. AUC = area under the curve.

Table 12. Monetary Equivalence Task: Effect of Standard Drinks on AUC

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Standard drinks	8.547	5.349	.110	-1.937	19.030
Elapsed day in the study	-0.952	0.997	.340	-2.907	1.002
Day of the week					
Monday	2.592	16.418	.875	-24.416	34.771
Tuesday	-2.976	20.497	.885	-43.149	37.198
Wednesday	-27.012	22.769	.236	-71.640	17.617
Thursday	11.026	20.928	.598	-29.994	52.045
Friday	8.722	30.494	.775	-51.045	68.490
Saturday	2.620	21.707	.904	-39.925	45.165
Between-person					
Standard drinks	-3.575	32.688	.913	-67.644	60.494
Age	7.559	2.448	.002	2.761	12.357

N (task iterations) = 531, *N* (persons) = 47. The output listed above is unstandardized. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for standard drinks and elapsed study day were centered at the person mean. All between-person variables were centered at the grand mean. AUC = area under the curve.

Table 13. Effort Discounting Task: Effect of Any Alcohol on AOC, Moderated by Partner Attractiveness

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Any alcohol	4.909	1.793	.006	1.395	8.423
Partner attractiveness	1.093	0.703	.120	-0.285	2.472
Alcohol X attractiveness	-1.557	1.219	.201	-3.946	0.832
Elapsed day in the study	-0.210	0.142	.141	-0.489	0.069
Day of the week					
Monday	-4.351	3.275	.184	-10.771	2.069
Tuesday	-4.760	2.969	.109	-10.580	1.059
Wednesday	2.983	2.508	.234	-1.932	7.899
Thursday	-0.517	2.580	.841	-5.574	4.540
Friday	0.426	2.869	.882	-5.198	6.049
Saturday	-4.147	2.884	.150	-9.800	1.505
Between-person					
Any alcohol	18.988	20.792	.361	-21.763	59.740
Partner attractiveness	4.791	3.928	.223	-2.908	12.490
Age	-0.179	0.560	.749	-1.277	0.918

N (task iterations) = 632, *N* (persons) = 49. The output listed above is unstandardized. Any alcohol was coded as 0 = no alcohol consumed, 1 = alcohol consumed. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for any alcohol, partner attractiveness, and elapsed study day were centered at the person mean, while the interaction term was created from centered within-person variables. All between-person variables were centered at the grand mean. AOC = area over the curve.

Table 14. Effort Discounting Task: Effect of Standard Drinks on AOC, Moderated by Partner Attractiveness

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Standard drinks	1.184	0.447	.008	0.308	2.061
Partner attractiveness	1.194	0.729	.101	-0.234	2.623
Standard drinks X attractiveness	-0.034	1.365	.980	-2.709	2.640
Elapsed day in the study	-0.219	0.143	.127	-0.501	0.062
Day of the week					
Monday	-4.667	3.375	.167	-11.283	1.948
Tuesday	-4.695	3.034	.122	-10.642	1.252
Wednesday	2.874	2.551	.260	-2.125	7.874
Thursday	-0.580	2.599	.823	-5.674	4.514
Friday	-0.117	2.951	.968	-5.900	5.666
Saturday	-4.608	2.896	.112	-10.283	1.068
Between-person					
Standard drinks	1.549	4.664	.740	-7.593	10.691
Partner attractiveness	5.326	3.881	.170	-2.281	12.932
Age	-0.111	0.605	.854	-1.291	1.070

N (task iterations) = 632, *N* (persons) = 49. The output listed above is unstandardized. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for standard drinks, partner attractiveness, and elapsed study day were centered at the person mean, while the interaction term was created from centered within-person variables. All between-person variables were centered at the grand mean. AOC = area over the curve.

Table 15. Effort Discounting Task: Effect of Any Alcohol on AOC, Moderated by Sexual Arousal

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Any alcohol	4.243	1.588	.008	1.131	7.355
Sexual arousal	2.112	1.300	.104	-0.436	4.659
Any alcohol X sexual arousal	-1.861	1.504	.216	-4.809	1.087
Elapsed day in the study	-0.210	0.135	.121	-0.476	0.055
Day of the week					
Monday	-3.698	3.019	.221	-9.615	2.220
Tuesday	-4.237	2.832	.135	-9.787	1.313
Wednesday	2.888	2.471	.243	-1.955	7.730
Thursday	-0.558	2.395	.816	-5.252	4.136
Friday	0.456	2.746	.868	-4.925	5.837
Saturday	-4.490	2.703	.097	-9.787	0.807
Between-person					
Any alcohol	21.392	19.706	.278	-17.232	60.016
Sexual arousal	5.958	3.805	.117	-1.500	13.416
Age	-0.192	0.560	.731	-1.290	0.905

N (task iterations) = 633, *N* (persons) = 49. The output listed above is unstandardized. Any alcohol was coded as 0 = no alcohol consumed, 1 = alcohol consumed. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for any alcohol, sexual arousal, and elapsed study day were centered at the person mean, while the interaction term was created from centered within-person variables. All between-person variables were centered at the grand mean. AOC = area over the curve.

Table 16. Effort Discounting Task: Effect of Standard Drinks on AOC, Moderated by Sexual Arousal

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Standard drinks	0.920	0.468	.049	0.002	1.837
Sexual arousal	2.124	1.338	.112	-0.499	4.747
Standard drinks X sexual arousal	-0.331	0.250	.185	-0.821	0.158
Elapsed day in the study	-0.226	0.139	.105	-0.499	0.047
Day of the week					
Monday	-3.964	3.067	.196	-9.975	2.047
Tuesday	-4.480	2.841	.115	-10.047	1.088
Wednesday	2.650	2.443	.278	-2.139	7.439
Thursday	-0.549	2.477	.825	-5.404	4.306
Friday	0.139	2.846	.961	-5.440	5.718
Saturday	-4.622	2.614	.077	9.746	0.502
Between-person					
Standard drinks	2.799	4.431	.528	-5.885	11.484
Sexual arousal	6.511	3.650	.074	-0.643	13.665
Age	-0.137	0.604	.821	-1.321	1.047

N (task iterations) = 633, *N* (persons) = 49. The output listed above is unstandardized. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for standard drinks, sexual arousal, and elapsed study day were centered at the person mean, while the interaction term was created from centered within-person variables. All between-person variables were centered at the grand mean. AOC = area over the curve.

Table 17. Effort Discounting Task: Effect of Heavy Drinking on AOC

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Heavy drinking	2.788	2.945	.344	-2.984	8.561
Elapsed day in the study	-0.225	0.143	.115	-0.505	0.055
Day of the week					
Monday	-4.694	3.307	.156	-11.175	1.787
Tuesday	-4.886	2.932	.096	-10.632	0.860
Wednesday	3.027	2.556	.236	-1.984	8.037
Thursday	-0.533	2.504	.831	-5.441	4.375
Friday	0.873	3.038	.774	-5.080	6.827
Saturday	-3.962	2.697	.142	-9.247	1.323
Between-person					
Heavy drinking	19.890	39.588	.615	-57.703	97.483
Age	0.025	0.628	.968	-1.205	1.256

N (task iterations) = 633, *N* (persons) = 49. The output listed above is unstandardized. Heavy drinking (five or more drinks consumed prior to task completion) was coded as 0 = no heavy drinking, 1 = heavy drinking. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for heavy drinking and elapsed study day were centered at the person mean. All between-person variables were centered at the grand mean. AOC = area over the curve.

Table 18. Condom Discounting Task: Effect of Any Alcohol on AOC, Moderated by Partner Attractiveness

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Any alcohol	0.234	6.316	.970	-12.146	12.614
Partner attractiveness	6.937	1.781	< .001	3.447	10.427
Alcohol X attractiveness	-2.173	3.075	.480	-8.201	3.854
Elapsed day in the study	-0.518	0.376	.168	-1.255	0.218
Day of the week					
Monday	-17.675	7.399	.017	-32.176	-3.174
Tuesday	-4.107	7.241	.571	-18.300	10.087
Wednesday	3.934	5.668	.488	-7.174	15.043
Thursday	2.445	7.027	.728	-11.328	16.218
Friday	2.103	7.635	.783	-12.862	17.067
Saturday	7.837	6.841	.252	-5.571	21.246
Between-person					
Any alcohol	50.561	27.398	.065	-3.140	104.262
Partner attractiveness	-6.738	6.675	.313	-19.821	6.345
Age	-0.419	0.884	.636	-2.152	1.314

N (task iterations) = 538, *N* (persons) = 46. The output listed above is unstandardized. Any alcohol was coded as 0 = no alcohol consumed, 1 = alcohol consumed. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for any alcohol, partner attractiveness, and elapsed study day were centered at the person mean, while the interaction term was created from centered within-person variables. All between-person variables were centered at the grand mean. AOC = area over the curve.

Table 19. Condom Discounting Task: Effect of Standard Drinks on AOC, Moderated by Partner Attractiveness

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Standard drinks	0.980	1.376	.477	-1.718	3.677
Partner attractiveness	7.506	2.145	< .001	3.302	11.710
Standard drinks X partner attractiveness	-1.612	3.312	.626	-8.104	4.880
Elapsed day in the study	-0.511	0.367	.164	-1.231	0.208
Day of the week					
Monday	-16.778	7.118	.018	-30.730	-2.826
Tuesday	-3.733	7.119	.600	-17.687	10.220
Wednesday	4.791	5.558	.389	-6.102	15.685
Thursday	3.037	7.045	.666	-10.772	16.846
Friday	1.912	7.828	.807	-13.431	17.255
Saturday	7.801	7.214	.280	-6.339	21.940
Between-person					
Standard drinks	3.279	7.081	.643	-10.599	17.157
Partner attractiveness	-6.035	6.827	.377	-19.416	7.347
Age	-0.154	0.980	.875	-2.075	1.768

N (task iterations) = 538, *N* (persons) = 46. The output listed above is unstandardized. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for standard drinks, partner attractiveness, and elapsed study day were centered at the person mean, while the interaction term was created from centered within-person variables. All between-person variables were centered at the grand mean. AOC = area over the curve.

Table 20. Condom Discounting Task: Effect of Any Alcohol on AOC, Moderated by Sexual Arousal

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Any alcohol	-5.696	5.919	.336	-17.297	5.906
Sexual arousal	1.746	1.202	.147	-0.611	4.103
Any alcohol X sexual arousal	7.986	4.531	.078	-0.893	16.866
Elapsed day in the study	-0.359	0.397	.366	-1.138	0.419
Day of the week					
Monday	-22.073	7.840	.005	-37.440	-6.707
Tuesday	-10.318	7.038	.143	-24.114	3.477
Wednesday	0.121	5.394	.982	-10.452	10.694
Thursday	0.993	7.254	.891	-13.224	15.210
Friday	0.058	7.229	.994	-14.110	14.227
Saturday	6.595	7.440	.375	-7.987	21.177
Between-person					
Any alcohol	42.629	30.884	.167	-17.903	103.162
Sexual arousal	3.217	6.529	.622	-9.579	16.013
Age	-0.443	0.909	.626	-2.224	1.338

N (task iterations) = 538, *N* (persons) = 46. The output listed above is unstandardized. Any alcohol was coded as 0 = no alcohol consumed, 1 = alcohol consumed. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for any alcohol, sexual arousal, and elapsed study day were centered at the person mean, while the interaction term was created from centered within-person variables. All between-person variables were centered at the grand mean. AOC = area over the curve.

Table 21. Condom Discounting Task: Effect of Standard Drinks on AOC, Moderated by Sexual Arousal

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Standard drinks	-1.127	1.610	.484	-4.282	2.029
Sexual arousal	1.762	1.287	.171	-0.761	4.284
Standard drinks X sexual arousal	0.816	0.359	.023	0.113	1.520
Elapsed day in the study	-0.332	0.390	.395	-1.096	0.432
Day of the week					
Monday	-21.772	7.728	.005	-36.918	-6.626
Tuesday	-10.076	7.368	.171	-24.517	4.365
Wednesday	0.061	5.665	.991	-11.042	11.165
Thursday	1.399	7.426	.851	-13.155	15.954
Friday	1.468	7.051	.835	-12.351	15.287
Saturday	6.150	7.707	.425	-8.956	21.255
Between-person					
Standard drinks	1.183	6.660	.859	-11.870	14.236
Sexual arousal	4.997	6.097	.412	-6.953	16.946
Age	-0.259	1.012	.798	-2.2143	1.724

N (task iterations) = 538, *N* (persons) = 46. The output listed above is unstandardized. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for standard drinks, sexual arousal, and elapsed study day were centered at the person mean, while the interaction term was created from centered within-person variables. All between-person variables were centered at the grand mean. AOC = area over the curve.

Table 22. Condom Discounting Task: Effect of Heavy Drinking on AOC

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Heavy drinking	7.263	9.062	.423	-10.499	25.025
Elapsed day in the study	-0.335	0.383	.382	-1.086	0.416
Day of the week					
Monday	-20.421	7.530	.007	-35.181	-5.662
Tuesday	-8.343	7.495	.266	-23.032	6.347
Wednesday	2.419	5.800	.677	-8.949	13.788
Thursday	3.092	7.595	.684	-11.793	17.977
Friday	5.579	7.249	.722	-11.630	16.788
Saturday	7.283	7.654	.341	-7.718	22.285
Between-person					
Heavy drinking	-6.027	54.100	.911	-112.062	100.008
Age	-0.121	1.006	.904	-2.093	1.850

N (task iterations) = 538, *N* (persons) = 46. The output listed above is unstandardized. Heavy drinking (five or more drinks consumed prior to task completion) was coded as 0 = no heavy drinking, 1 = heavy drinking. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for heavy drinking and elapsed study day were centered at the person mean. All between-person variables were centered at the grand mean. AOC = area over the curve.

Table 23. Monetary Equivalence Task: Effect of Any Alcohol on AUC, Moderated by Partner Attractiveness

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Any alcohol	23.157	16.880	.170	-9.927	56.241
Partner attractiveness	33.455	5.310	< .001	23.049	43.862
Any alcohol X attractiveness	7.458	8.761	.395	-9.715	24.630
Elapsed day in the study	-0.787	1.050	.454	-2.844	1.271
Day of the week					
Monday	0.504	14.640	.973	-28.191	29.198
Tuesday	1.312	19.402	.946	-36.716	39.341
Wednesday	-23.616	19.161	.218	-61.171	13.939
Thursday	13.663	19.966	.494	-25.471	52.797
Friday	9.477	25.918	.715	-41.322	60.277
Saturday	32.195	21.885	.141	-10.700	75.090
Between-person					
Any alcohol	-8.811	124.875	.944	-253.566	235.944
Partner attractiveness	51.031	38.997	.191	-25.402	127.464
Age	7.035	2.463	.004	2.206	11.863

N (task iterations) = 531, *N* (persons) = 47. The output listed above is unstandardized. Any alcohol was coded as 0 = no alcohol consumed, 1 = alcohol consumed. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for any alcohol, partner attractiveness, and elapsed study day were centered at the person mean, while the interaction term was created from centered within-person variables. All between-person variables were centered at the grand mean. AUC = area under the curve.

Table 24. Monetary Equivalence Task: Effect of Standard Drinks on AUC, Moderated by Partner Attractiveness

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Standard drinks	4.472	4.102	.276	-3.568	12.512
Partner attractiveness	33.390	5.285	< .001	23.031	43.748
Standard drinks X partner attractiveness	-0.470	1.620	.772	-3.645	2.706
Elapsed day in the study	-0.808	1.037	.436	-2.841	1.225
Day of the week					
Monday	-0.180	14.678	.990	-28.948	28.588
Tuesday	-0.400	19.043	.983	-37.724	36.924
Wednesday	-25.306	18.851	.179	-62.254	11.643
Thursday	13.979	20.213	.489	-25.638	53.596
Friday	12.000	26.562	.651	-40.062	64.061
Saturday	31.834	21.725	.143	-10.746	74.414
Between-person					
Standard drinks	3.111	27.829	.911	-51.433	57.655
Partner attractiveness	51.323	38.046	.177	-23.248	125.893
Age	7.005	2.339	.003	2.421	11.589

N (task iterations) = 531, *N* (persons) = 47. The output listed above is unstandardized. For day-of-the-week indicators, Sunday was used as the reference day. Within- person variables for standard drinks, partner attractiveness, and elapsed study day were centered at the person mean, while the interaction term was created from centered within-person variables. All between-person variables were centered at the grand mean. AUC = area under the curve.

Table 25. Monetary Equivalence Task: Effect of Any Alcohol on AUC, Moderated by Sexual Arousal

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Any alcohol	32.036	20.730	.122	-8.595	72.666
Sexual arousal	2.493	3.328	.454	-4.030	9.016
Any alcohol X sexual arousal	1.156	11.430	.919	-21.247	23.558
Elapsed day in the study	-0.840	0.946	.375	-2.693	1.014
Day of the week					
Monday	2.160	16.061	.893	-29.319	33.639
Tuesday	-3.203	20.414	.875	-43.215	36.808
Wednesday	-26.079	23.060	.258	-71.276	19.118
Thursday	9.401	20.948	.654	-31.657	50.460
Friday	6.632	29.754	.824	-51.685	64.949
Saturday	2.127	21.778	.922	-40.558	44.812
Between-person					
Any alcohol	-7.342	118.534	.951	-239.668	224.983
Sexual arousal	2.199	25.851	.932	-48.469	68.787
Age	7.586	2.607	.004	2.475	14.302

N (task iterations) = 531, *N* (persons) = 47. The output listed above is unstandardized. Any alcohol was coded as 0 = no alcohol consumed, 1 = alcohol consumed. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for any alcohol, sexual arousal, and elapsed study day were centered at the person mean, while the interaction term was created from centered within-person variables. All between-person variables were centered at the grand mean. AUC = area under the curve.

Table 26. Monetary Equivalence Task: Effect of Standard Drinks on AUC, Moderated by Sexual Arousal

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Standard drinks	8.224	5.454	.132	-2.466	18.913
Sexual arousal	2.780	2.944	.345	-2.990	8.550
Standard drinks X sexual arousal	-1.189	1.987	.550	-5.084	2.706
Elapsed day in the study	-0.939	0.994	.345	-2.888	1.010
Day of the week					
Monday	2.870	16.559	.862	-29.585	35.325
Tuesday	-2.072	20.573	.920	-42.395	38.252
Wednesday	-26.567	22.985	.248	-71.618	18.484
Thursday	10.888	21.070	.605	-30.409	52.186
Friday	7.804	30.460	.798	-51.897	67.505
Saturday	2.821	21.804	.897	-39.914	45.556
Between-person					
Standard drinks	-4.176	29.357	.887	-61.714	53.363
Sexual arousal	2.741	28.451	.923	-53.022	58.504
Age	7.553	2.478	.002	2.697	12.410

N (task iterations) = 531, *N* (persons) = 47. The output listed above is unstandardized. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for standard drinks, sexual arousal, and elapsed study day were centered at the person mean, while the interaction term was created with centered within-person variables. All between-person variables were centered at the grand mean. AUC = area under the curve.

Table 27. Monetary Equivalence Task: Effect of Heavy Drinking on AUC

				95% CI	
Variable	Estimate	(SE)	p	Lower	Upper
Within-person					
Heavy drinking	43.040	39.695	.278	-34.761	120.842
Elapsed day in the study	-1.069	0.988	.279	-3.005	0.868
Day of the week					
Monday	2.080	16.073	.897	-29.423	33.584
Tuesday	-4.609	20.755	.824	-45.289	36.071
Wednesday	-28.468	22.123	.198	-71.830	14.894
Thursday	12.274	21.135	.561	-29.149	53.698
Friday	11.261	31.643	.722	-50.760	73.281
Saturday	2.896	21.636	.894	-39.510	45.302
Between-person					
Heavy drinking	-120.324	224.718	.592	-560.772	320.123
Age	7.484	2.463	.002	2.656	12.312

N (task iterations) = 531, *N* (persons) = 47. The output listed above is unstandardized. Heavy drinking (five or more drinks consumed prior to task completion) was coded as 0 = no heavy drinking, 1 = heavy drinking. For day-of-the-week indicators, Sunday was used as the reference day. Within-person variables for heavy drinking and elapsed study day were centered at the person mean. All between-person variables were centered at the grand mean. AUC = area under the curve.

Table 28. Effort Discounting Task: Point-by-Point Analysis

	Any Alcohol		Standard Drinks	
	Estimate	p	Estimate	p
Total AOC	4.766	.011	0.914	.056
Discounting Point				
0 minutes	-3.823	.078	-0.884	.163
5 minutes	-5.246	.032	-1.664	.076
10 minutes	-6.052	.014	-1.845	.024
30 minutes	-3.943	.040	-1.069	.089
45 minutes	-4.726	.006	-0.923	.053
60 minutes	-4.268	.015	-0.729	.040
120 minutes	-2.053	.259	-0.089	.789

N (task iterations) = 768 (for total AOC), 769 (for all discounting points), *N* (persons) = 51. The output listed above is unstandardized. Any alcohol was coded as 0 = no alcohol consumed, 1 = alcohol consumed. Variables for any alcohol and standard drinks were centered at the person mean. AOC = area over the curve.

Table 29. Condom Discounting Task: Point-by-Point Analysis

	Any Alcohol		Standard Drinks		Partner Attractiveness	
	Estimate	p	Estimate	p	Estimate	p
Total AOC	-1.761	.721	0.573	.546	6.226	< .001
Discounting Point						
0 minutes	-1.717	.360	-0.711	.155	-1.448	.035
10 minutes	0.219	.903	-0.213	.616	0.100	.874
20 minutes	-0.452	.847	-0.313	.468	-0.299	.649
1 hour	1.495	.567	0.036	.932	-0.986	.170
2 hours	0.803	.765	0.169	.675	-2.355	.009
4 hours	0.507	.856	-0.455	.385	-2975	.001
1 day	0.795	.781	-0.373	.490	-3.339	.001
3 days	1.029	.732	-0.360	.529	-3.857	< .001
7 days	1.407	.665	-0.285	.660	-4.043	< .001

N (task iterations) = 657 (for alcohol effects), 658 (for partner attractiveness effects), *N* (persons) = 50. The output listed above is unstandardized. Any alcohol was coded as 0 = no alcohol consumed, 1 = alcohol consumed. Variables for any alcohol, standard drinks, and partner attractiveness were centered at the person mean. AOC = area over the curve.

Table 30. Monetary Equivalence Task: Point-by-Point Analysis

	Any Alcohol		Standard Drinks		Partner Attractiveness	
	Estimate	p	Estimate	p	Estimate	p
Total AUC	8.026	.558	2.476	.441	32.894	< .001
Equivalence Point						
$1	-3.311	.126	-0.363	.380	6.079	< .001
$10	-4.259	.064	-0.453	.264	6.979	< .001
$25	-2.725	.309	-0.089	.841	7.203	< .001
$50	-0.532	.796	0.248	.575	6.630	< .001
$75	0.755	.712	0.434	.336	6.076	< .001
$100	1.609	.388	0.421	.378	5.608	< .001
$250	2.712	.176	0.621	.261	4.100	< .001
$500	1.017	.468	0.277	.377	2.787	< .001
$1000	-0.568	.569	-0.091	.633	1.379	.010

N (task iterations) = 739 or 740, *N* (persons) = 50. The output listed above is unstandardized. Any alcohol was coded as 0 = no alcohol consumed, 1 = alcohol consumed. Variables for any alcohol, standard drinks, and partner attractiveness were centered at the person mean. AUC = area under the curve.

Figures

Figure 1. CONSORT Diagram

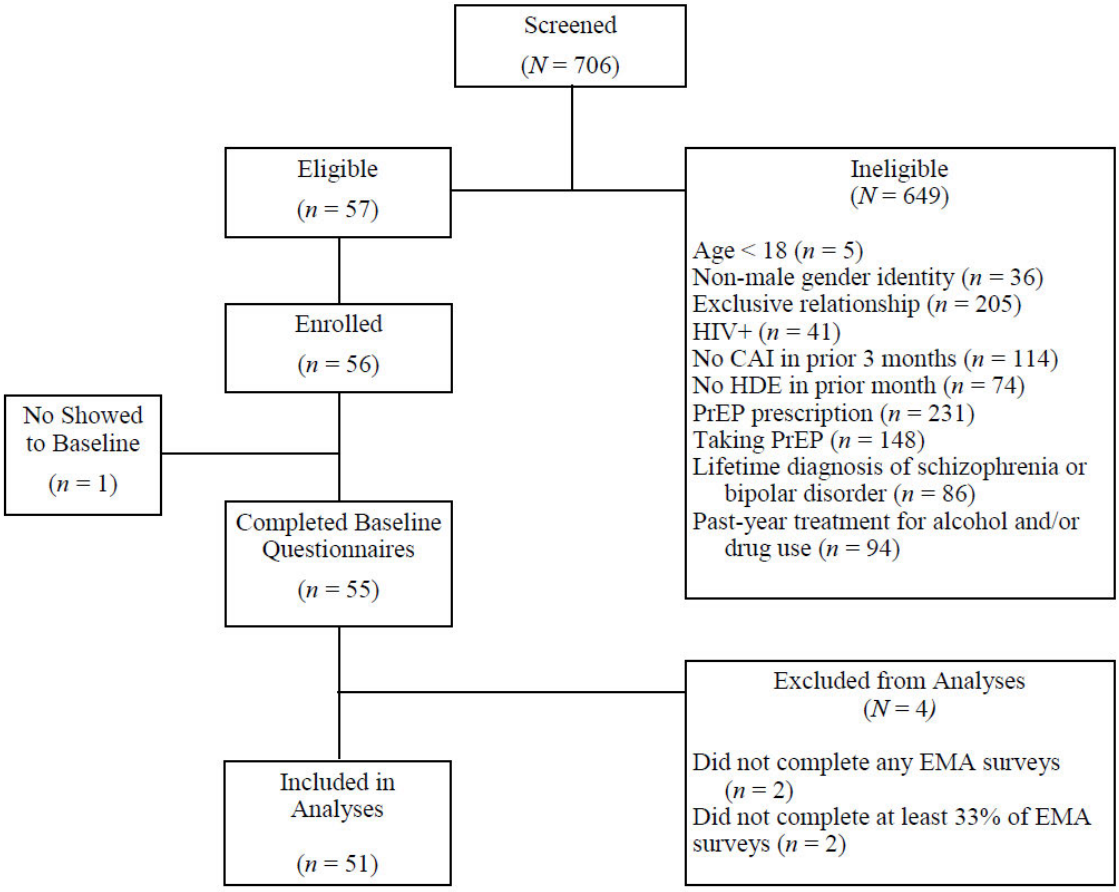


Figure 1. CONSORT diagram illustrating flow of participants through the study. CAI = condomless anal intercourse. EMA = ecological momentary assessment. HDE = heavy-drinking episodes (five or more drinks during a single drinking occasion, per Wechsler et al., 2002). PrEP = pre-exposure prophylaxis.

Figure 2. Effort Discounting Task: Mean Standardized Scores

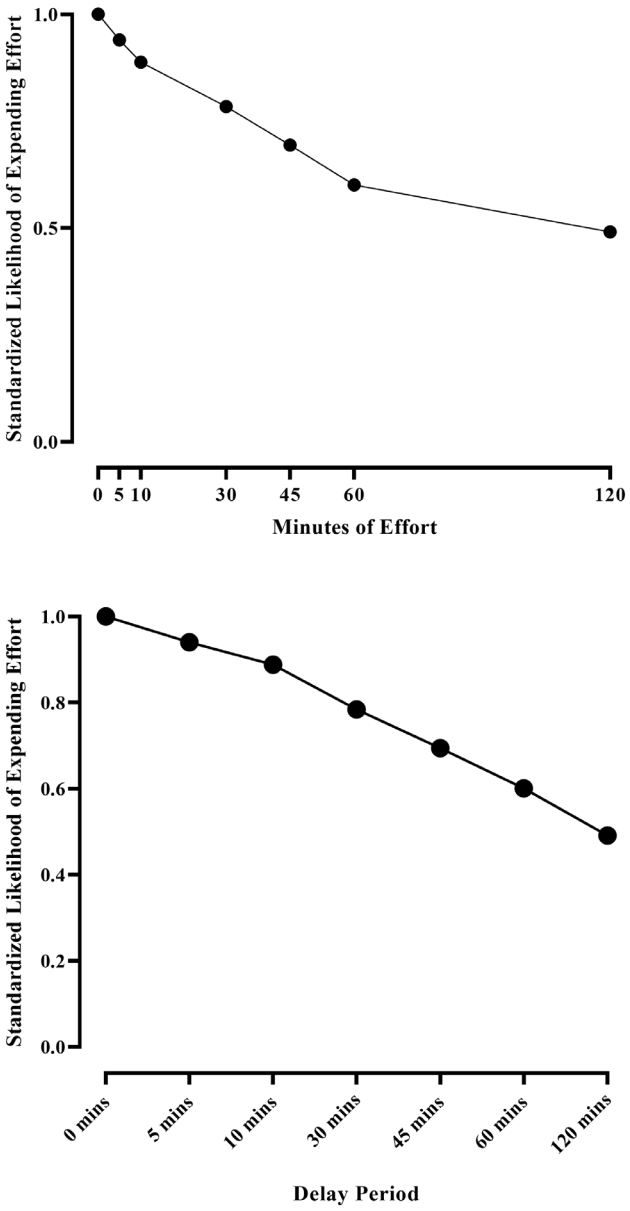


Figure 2. Mean effort discounting task scores per delay period, using systematic, standardized trials only. Top panel shows mean delays on a linear x-axis to allow characterization of discounting curve. Bottom panel shows delays with delay periods evenly spaced on the x-axis.

Figure 3. Condom Discounting Task: Mean Standardized Scores

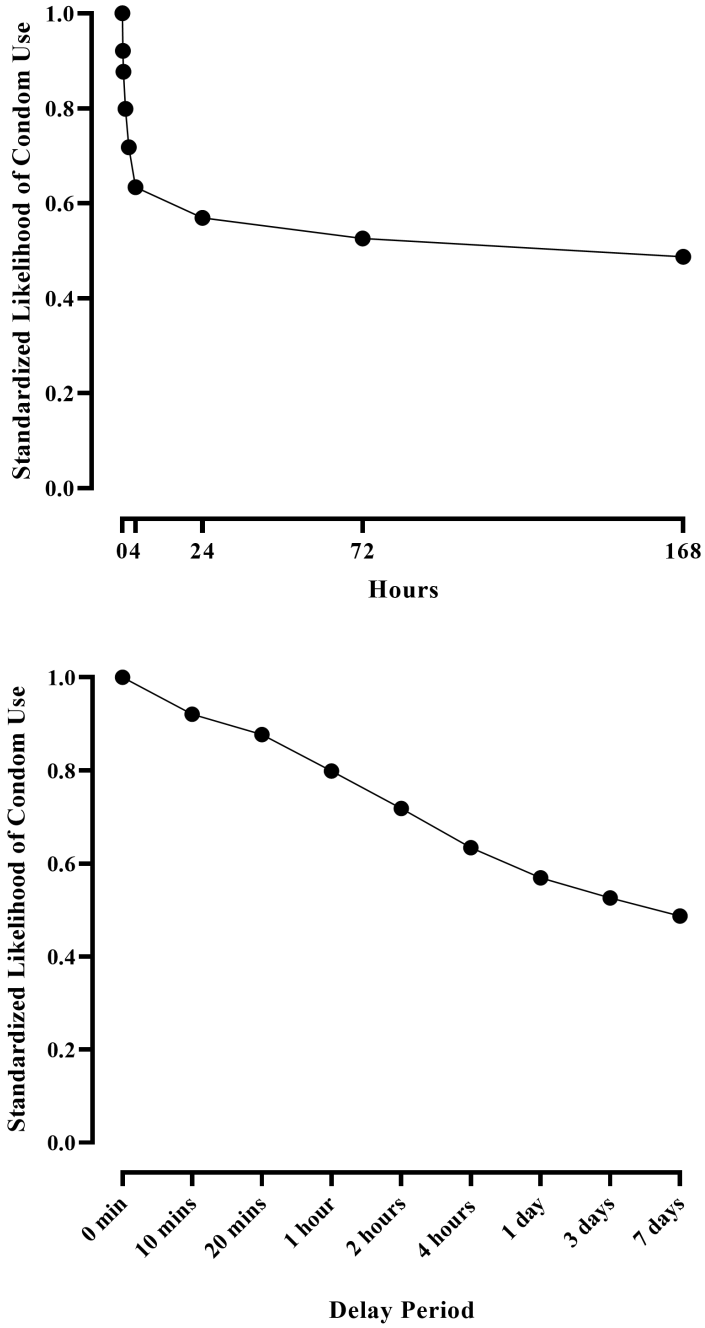


Figure 3. Mean condom discounting task scores per delay period, using systematic, standardized trials only. Top panel shows mean delays on a linear x-axis to allow characterization of discounting curve. Bottom panel shows delays with delay periods evenly spaced on the x-axis.

Figure 4. Monetary Equivalence Task: Mean Standardized Scores

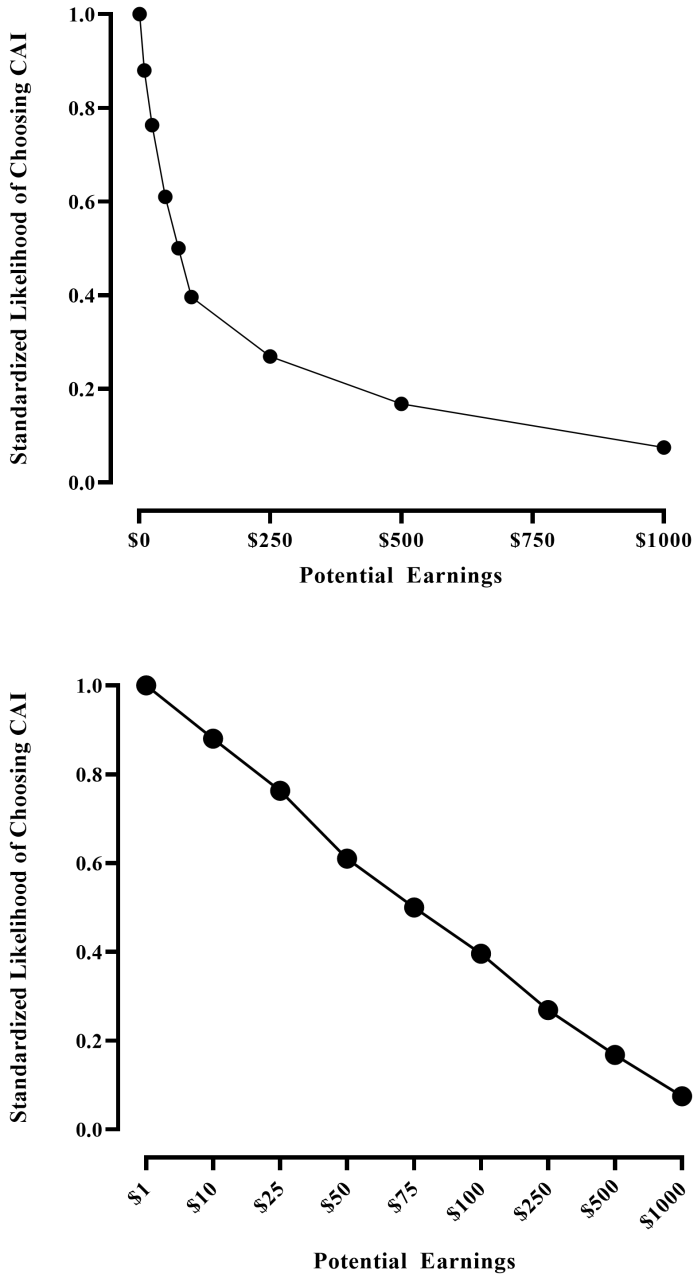


Figure 4. Mean monetary equivalence task scores per amount of potential earnings, using systematic, standardized trials only. Top panel shows mean equivalence scores on a linear x-axis to allow characterization of discounting curve. Bottom panel shows mean equivalence scores with potential earnings evenly spaced on the x-axis. CAI = condomless anal intercourse.

Figure 5. Condom Discounting Task: Interaction Between Alcohol Consumption and Sexual Arousal

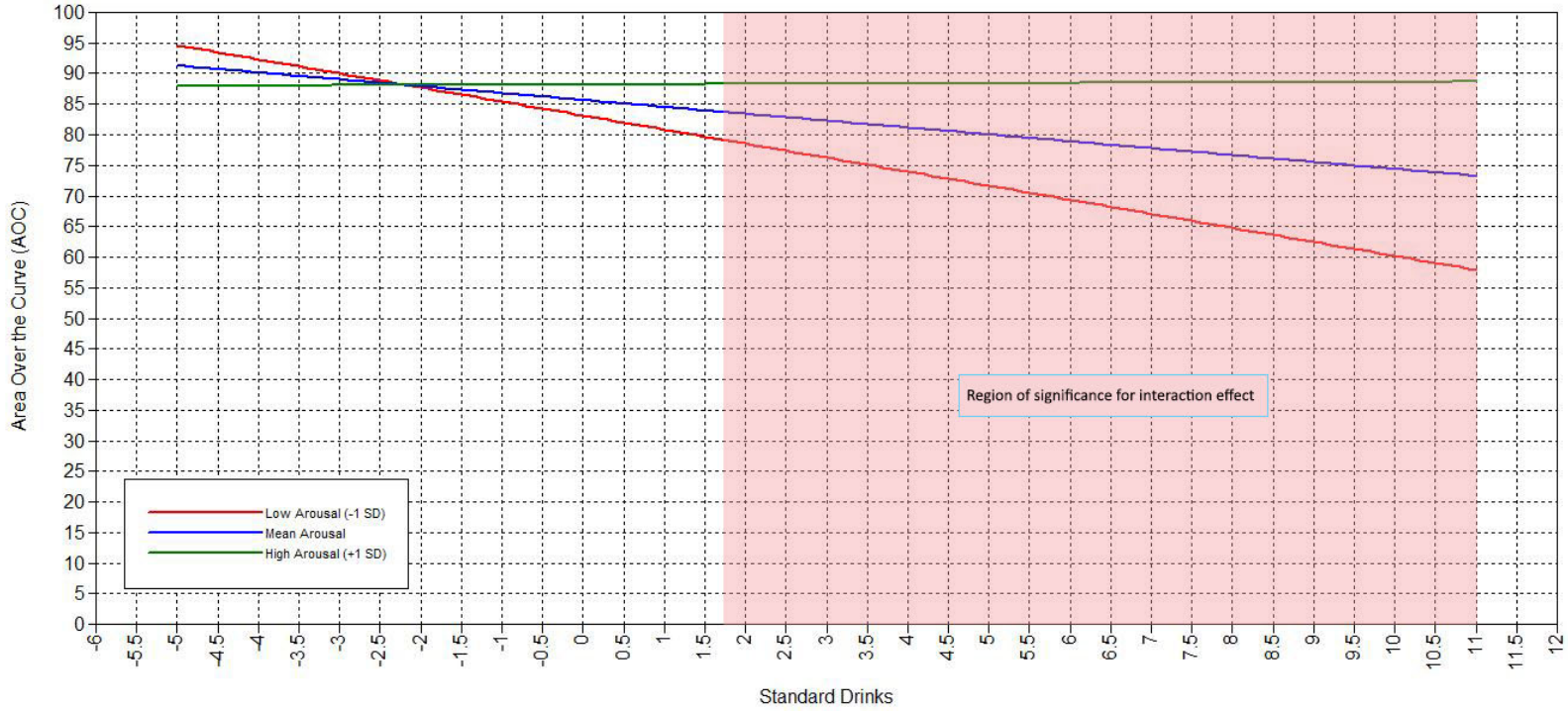


Figure 5. Region of significance for interaction effect of alcohol consumption (measured in standard drinks) and sexual arousal.

Appendix A: Facebook Groups Targeted for Study Advertising

Group Name	State
Gaymers of Boston	MA
Gay Men of Mass	MA
Gay Maine	ME
Gay New England	
Modern Gay Connecticut	CT
Gay New Hampshire	NH
LGBTQ Florida	FL
Atlanta Gay and Bi Connect	GA
LGBTQ West Virginia	WV
Kentucky Gay Geeks	KY
Vermont Gay Guys	VT
LGBTQ+ Kentucky	KY
Gay Northeast Ohio GLBTQ	OH
Gay and Lesbian Nashville	TN
NYC Gamers	NY
Queer Wisconsin	WI
LGBT Michigan	MI
NYC Gay Nightlife	NY
New Jersey LGBT	NJ
New York LGBTQ Events and Nightlife	NY
LGBTQ of South Florida	FL
Indiana LGBTQ+	IN
NYC Gay and Bi Singles	NY
Locally-Sourced Gays	
Missouri and Midwest LGBTQ	MO
The Friendly Gays of New Orleans	LA
Chicago Gay Nightlife	IL
Gay New Orleans	LA
Proud & Out Alabama	AL
Gay Michigan	MI
Gay Men of Houston	TX
LGBTQIA+ Nebraska	NE
LGBTQ South Carolina	SC
Gays of Lubbock	TX
Texas Gay Social Group	TX
LGBTQ Denver	CO
Denver Gay Social & Adventure Group	CO

Queer Friends Colorado Springs	CO
Gay Guys of Orlando	FL
Utah Gay Forum	UT
Utah Gay Activities	UT
Las Vegas Gaymers	NV
LGBTQ Las Vegas Group	NV
Gay Outdoors Tucson	AZ
Utah Gay Men's Resource Network	UT
Gay Portland	OR
Central Oregon LGBTQIA+ and Allies	OR
Orange County Gay Friends Network	CA
Gay Sacramento Single Men's Group	CA
Gay Guys NY	NY
San Antonio Gayborhood	TX
Varsity Gay League: Los Angeles	CA
Chicago Gays Unite	IL
Gay Men of Pennsylvania	PA
Gay Fellas LA	CA
Gay Dating USA	
LGBTQ in KC	MO
Varsity Gay League: Dallas	TX
Dallas Rainbow Lounge	TX
Jacksonville Florida LGBT+	FL
Columbus Board Gaymers	OH
Charlotte LGBTQ	NC
LGBTQ+ of Charlotte & Surrounding	NC
Varsity Gay League - San Francisco	CA
LGBT of Charlotte	NC
Seattle Gaymers	WA
Seattle LGBT Community	WA
LGBTQ Housing & Employment Network - Columbus OH	OH
Seattle Nightlife	WA
Metro Detroit LGBTQ Millennials	MI
San Diego (LGBT local networking)	CA
LGBTQIA Nashville	TN
Denver Gay & Lesbian Flag Football League	CO
The Official Nashville LGBT Social Club	TN
Memphis LGBTQ Social Group	TN
Las Vegas Gay Singles Looking for Relationships	NV

Southern Kentucky LGBTQIA Community	KY
PDX Gaymers	OR
Kentucky and Indiana LGBT	KY
LGBT+ Kentucky	KY
LGBTQ Portland	OR
Mid-Atlantic Gay Men's Group	
Baltimore & Burbs LGBTQ+ Social Networking	MD
New Queer Friends - Boston	MA
LGBTQ Milwaukee Events	WI
PDX LGBTQ Online	OR
Single Cubs and Bears of Massachusetts	MA

Appendix B: Email Templates for Recruiting

After Expressing Interest

Thanks for your interest! Please follow the link below to learn a bit more about the study and complete a set of online screening questions that will allow us to determine if you're eligible for the study.

https://acsurvey.qualtrics.com/jfe/form/SV_6gppuqqq8KTQtCZ

Thanks,
Peter

Ineligible

Thanks for completing the online screener! Unfortunately, you're not eligible for the study.

We really appreciate your interest and are sorry that we can't enroll you into this study.

We'd be happy to let you know about future studies in our lab. If you're interested, please reply to this email to let us know that you'd like to be added to our mailing list.

All best,
The Decision-Making Study Team

Once Eligible

Dear Participant,

Good news! You're eligible for the study!

Thank you for completing the online screening questionnaires. Your responses indicate that you are eligible for the study, and we're eager to get you started as soon as possible.

Next Steps

To kick things off, we want to schedule a short Zoom or telephone call with you, so that we can go over some instructions, answer any questions you might have, and enroll you in the survey app we'll be using for this study. This call should take about 10 minutes.

Once we've completed the call, you can get started on the online questionnaires. These should take between 30 minutes and one hour to complete, depending on how quickly you answer the questions.

Once you complete the online questionnaires, you'll receive an e-mail with instructions on how to start the survey portion of the study.

Please let us know when you'll be available for a Zoom or telephone call.

If possible, it would be great to try to connect on [date].

Thank you

Appendix C: Consent Form for Eligibility Questionnaires

Screening Survey Informed Consent

You are invited to participate in a screening survey to determine your eligibility for a study with gay and bisexual men who are at least 18 years old. This study will examine how alcohol affects sexual risk behavior, including decisions about condom use. This research project is being conducted by Peter Luehring-Jones, MA, and Tibor Palfai, PhD, both at Boston University. The screening survey should take approximately 10 minutes to complete.

Your participation in this survey is voluntary. You may refuse to take part in the research or exit the survey at any time with no penalty. You are free to decline to answer any particular question you may not wish to answer. However, if we do not have enough information to determine your eligibility for this study, we will be unable to enroll you in this study.

Confidentiality

We will take all steps possible to ensure the confidentiality of the information you provide to us. If you agree to be screened for this research study by selecting "Agree" on the bottom of this page you will have access to the screening questions that start on the next page of this survey. We will ask you to provide an e-mail address when you complete the survey. Therefore, your responses will be linked to your e-mail address. No other identifying information will be collected during the survey. Upon completion of the survey, your responses will be downloaded from the survey platform (access to which is password protected and only accessible to the study staff). Your e-mail address will be used to inform you of your eligibility for the study. No participants will be identifiable in any presentations or publications of this study's findings.

If you DO NOT agree to be screened for this research study, please select "Disagree" on the bottom of this page. You will then be directed to an end of survey screen. All data will be kept confidential with the exception of the following: (1) report of abuse or neglect of any child, elderly person, or disabled person, or (2) expressed intent to harm yourself or someone else, which we will or may report to appropriate authorities.

Benefits and Risks

There is no direct benefit to you from participating in this survey. You will not receive any compensation for participating in this survey.

There is a possibility that answering questions about your alcohol and drug use and other health behaviors may cause you to feel uncomfortable. You are free to refuse to answer

any questions that make you uncomfortable and you may withdraw from the survey at any time without penalty.

Some of the questions will be about personal information, including health information. Please be sure that you are in a private place where you feel comfortable answering these questions when filling out this survey.

Electronic Consent

Please select your choice below. You may print a copy of this consent form for your records.

Clicking on the "Agree" button indicates that:

- You have read the information above
- You voluntarily agree to complete the screening survey
- You are 18 years of age or older

Please contact Peter Luehring-Jones at alclab@bu.edu with any questions.

Appendix D: Consent Form for Study

Informed Consent
Study: Alcohol and the Decision-Making: EMA Study (Study 4)
Principal Investigator: Tibor Palfai, Ph.D.

The Project

The purpose of this study is to understand more about alcohol use and decision-making in your everyday life. There are two parts to the study. The baseline session, during which you will complete questionnaires about your health behaviors, will take place today. The Ecological Momentary Assessment (EMA) portion, during which you will respond to surveys on your smartphone, will start tomorrow evening. The EMA portion of the study will last for 32 days.

Today's baseline session will last for approximately one hour.

The surveys for the EMA portion will appear twice each day: once in the morning and once in the evening. The morning survey will appear at 8 am each day and will remain available until 2 pm. You will respond to questions about drinking, drug use, and sexual activity from the previous evening. Completion of the morning survey should take no longer than 5 minutes. The evening survey will appear once each evening, at random times between 7:30 pm and 11:00 pm. You will have one hour to complete the survey after it appears on your phone. During the evening survey, you will answer questions about any current alcohol or drug consumption, as well as about any plans to have sex that evening. You will also respond to questions about hypothetical sexual situations. The evening survey should take no longer than 10 minutes to complete.

If you decide to leave the study before it is over, we will keep the data you have already provided to us confidential, and you will be compensated for the effort you have contributed to the study up until the point of your withdrawal.

Risks

There may be some risks from being in this study. Answering questions about your alcohol and drug consumption as well as sexual behaviors may make you uncomfortable. If you begin to feel uncomfortable answering these questions, you are free to withdraw from participation at any time.

Some of the assessments inquire about personal information such as alcohol and drug consumption, as well as sexual behaviors. Thus there is a risk that individuals may learn about private information that you disclose. All of your data are coded by number rather than your name, and we will make every effort to protect your privacy and the

confidentiality of the data. However, there is minimal risk of your data being connected to your identity while in the study.

Other individuals may notice that you are in a research study and inquire about your involvement or the assessment questions. The mobile assessments are designed to be minimally intrusive. However, the assessments may be disruptive at times.

In addition to the risks described, there may be unknown risks, or risks that we did not anticipate, associated with being in this study.

Benefits

You may not benefit personally from being in this study, though some find the self-monitoring interesting and informative about their behavior. However, we hope the information gained will contribute to our learning more about the association between alcohol and decision-making.

Confidentiality

We will take all steps possible to ensure the confidentiality of the information you provide us. In this regard, all information collected in this study will be coded by number (not name) and kept in locked offices and password-protected files on computers. The mobile application is password protected and previous responses cannot be accessed from within the application. In addition, passwords and data are encrypted when transmitted across the network and data on the server is stored with password protection. The information we collect from you will be accessible only to designated research staff. In addition, no research participant will be individually identifiable in any presentation or publication of the findings of this research.

We will keep your study data and information obtained in the study confidential, with the exception of certain information we must report for legal or ethical reasons, namely abuse (of children, elderly persons, or disabled persons) or intent to harm yourself or others. We may disclose medical information in cases of medical necessity. To help protect your privacy, we have obtained a Certificate of Confidentiality from the National Institutes of Health. The certificate does not mean that the Secretary of the Department of Health and Human Services (DHHS) approves or disapproves of the project. This certificate allows researchers to maintain the confidentiality of your information even if the court orders a subpoena as part of federal, state or local legal proceedings. The investigators will use the Certificate to resist any requests for information that would identify you except in cases of government audit of this study.

There are other limits to confidentiality of which each participant should be aware. Disclosures of current child abuse, senior citizen abuse, disabled person abuse, or intention to inflict physical harm to yourself or another may be reported. It should be noted that there are no specific questions that are asked in this study that explicitly refer to these issues. Please note, if in the course of this study, you communicate this information, the principal investigator may report it to law enforcement officials. IN ADDITION, if you disclose your participation in the study or if another party learns of your participation in the research study then we may not use the NIH Certificate of Confidentiality (CoC) to withhold this information. All other procedures to safeguard confidentiality of responses described above, however, will be applied.

We may deposit data collected during this study to online data repositories and/or share such data with other researchers if we deem such deposit and/or sharing to be in the best interests of scientific research or experimental transparency. Data that is deposited or shared will not contain any identifying information.

Contact Information

Any questions, concerns, or complaints that you have about this study should be directed to the Study Coordinator at 617-353-0962 or by email at alclab@bu.edu. You may also contact Dr. Tibor Palfai at 617-353-9345. Any questions about your rights as a research subject should be directed to the Boston University (Charles River Campus) IRB office at 617-353-6115 or irb@bu.edu.

Compensation

Individuals participating in this study will receive compensation for their time and effort. You will receive $30 for completing the baseline session, plus $2 for each morning survey completed and $3 for each evening survey completed. If you were to respond to each and every survey, you could earn a maximum of $190 for your participation in this survey.

You can elect to be compensated in one of two ways. First, you can elect to receive your compensation in the form of an Amazon.com gift card, which will be delivered to you via e-mail. Alternatively, you can elect to receive your compensation by check, which will be mailed to you after processing by staff at Boston University. In order to issue a check to you, certain personal information (like name and address) will be shared with Boston University staff in the university's accounts payable office. You acknowledge that you agree to this information sharing if you do request payment by check.

Rights of Participant

You are free to refuse participation in the study, decline to answer questions, or withdraw from the study at any time without penalty or loss of benefits. If you are a student of Boston University, you should know that declining or discontinuing participation in the study will not affect your status as a student in any way. A copy of this consent form, with your electronic signature and today's date affixed, will be e-mailed to you after you complete this form and agree to the terms it contains.

After reading the consent form, do you wish to participate in the study?

__ Yes – I want to participate in the study

__ No – I do NOT want to participate in the study

[IF YES]

Agreement to Participate in the Study

By entering my full name below, I indicate that all of my questions about the study have been answered, and that I willingly volunteer to participate in the study.

I also certify the following:

- I am at least 18 years old
- I have access to a data-enabled smartphone running the either Android or iOS operating system and am willing to use that smartphone for the EMA portion of this study

Please enter your full name into the text box below. This will serve as your electronic signature for this consent form.

[IF NO]

Thank you for your interest in the study!

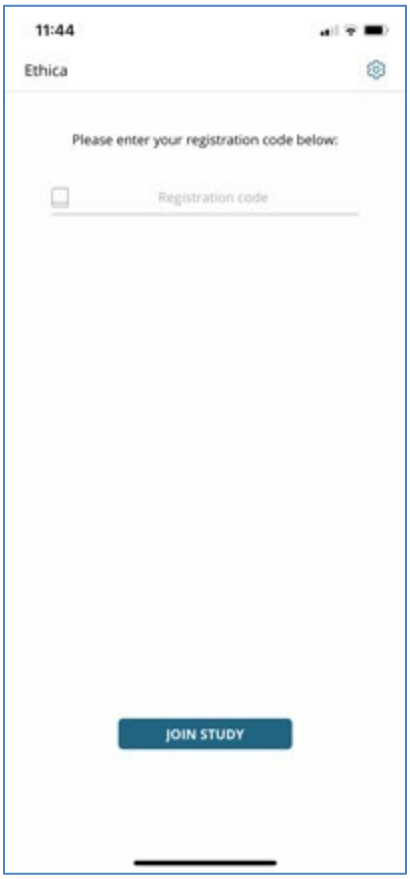
Please close the window to exit this form and end the consent process.

Appendix E: Instructions for Enrolling in Ethica Surveys

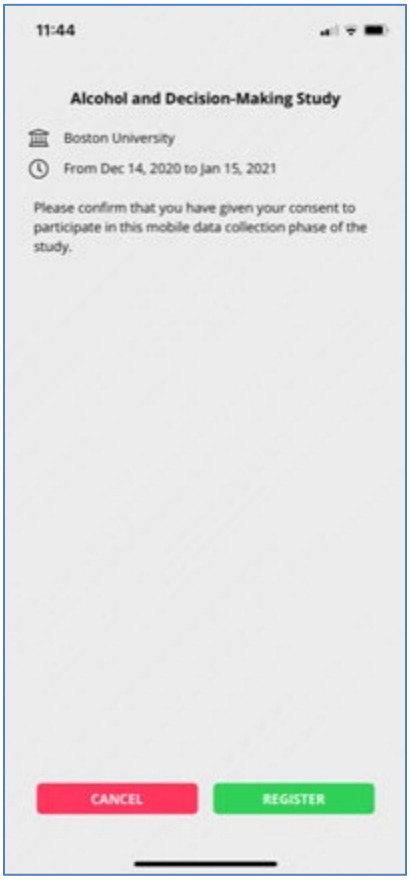
You've completed the baseline questionnaires and can now enroll into the survey portion of the study.

Please follow the instructions below:

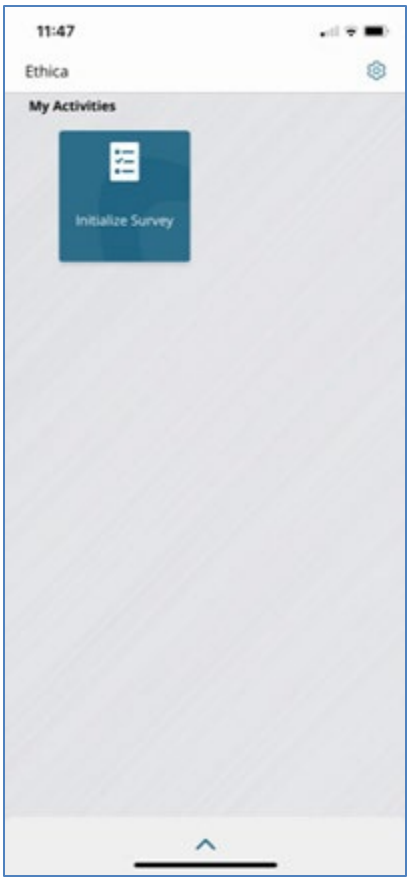
1. Open the Ethica app. You should see a page that says "Please enter your registration code below." Enter code **1280** as the registration code and then click "join study".



2. You'll be taken to a screen with a short consent statement, indicating that you've already given consent to be part of this study. Click on the green "Register" button.



3. You'll be taken to the "My Activities" page for the study. You should see a survey called the "Initialize Survey" (as in the image below). Please click on that survey and enter your participant ID number. Your participant ID number is **[ID number]**.



4. All done! You're now enrolled in the survey portion of the study.

This will be your schedule of surveys over the new two days:

Today, [date] only the Initialize Survey.
Tomorrow, [date]: the first Evening Survey, which will be prompted for completion at a random time between 7:30 pm and 11:00 pm in the evening. Once prompted, you'll have one hour to finish the survey.
The day after tomorrow, [date]: This is the first day on which you'll receive both the Morning Survey and the Evening Survey. The morning survey will be prompted at 8 am each morning and will be available until 2 pm. The evening survey will again be prompted at a random time between 7:30 pm and 11:00 pm, with one hour for you to complete the survey after you receive the prompt.

Your final day in the study will be on **[date]**, when you'll receive your final morning survey. There will be no evening survey on that day.

Please e-mail us at alclab@bu.edu or call/text us at (617) 410-8305 with any questions!

All best,
The Decision-Making Study Team

Appendix F: Morning Survey Questions

1. Where are you?
   - Options: Home
     Work
     School
     Recreational place
     Bar or club
     Restaurant
     Friend or relative's home
     In transit
     Other

2. Who are you with?
   - Options: I am alone
     I am with a romantic partner
     I am with my family
     I am with friends
     I am in a social setting with people I know
     I am in a social setting with people I don't know
     Other

3. Did you drink last night?
   - Options: Yes
     No

   IF YES

   4. How many standard drinks did you have last night? (free response)

   5. How long did it take you to drink those drinks? (free response)

   6. How intoxicated did you get last night? (0-7 scale)

7. Did you use any drugs last night?
   - Options: Yes
     No

   IF YES

   8. Which drugs did you use last night?
      - Options: Cannabis (marijuana, pot, grass, hash, etc.)
        Cocaine (coke, crack, etc.)

Prescription stimulants (Ritalin, Concerta, Dexedrine, Adderall, diet pills, etc – ONLY if they were not prescribed to you)
Methamphetamine (speed, crystal meth, ice, etc.)
Inhalants (nitrous oxide, poppers, glue, gas, paint thinner, etc.)
Sedatives or sleeping pills (Valium, Serepax, Ativan, Xanax, Librium, Rohypnol, GHB, etc. – ONLY if they were not prescribed to you)
Hallucinogens (LSD, acid, mushrooms, PCP, Special K, ecstasy, etc.)
Street opioids (heroin, opium)
Prescription opioids (fentanyl, oxycodone [Oxycontin, Percocet], hydrocodone [Vicodin], methadone, buprenorphine, etc. – ONLY if they were not prescribed to you)
Other

9. How high did you get last night? (0-7 scale)

10. Did you have sex with a man last night?
Options: Yes
No

IF YES

11. Which of the following terms best describes your relationship with this man?
Options: Anonymous (he and I just met)
Casual (we have sex sometimes)
Regular (we have sex frequently)

12. How long have you known this man?
Options: We met yesterday
Less than a week
1-3 weeks
A month
2-3 months
4-6 months
6-12 months
1 year
2-3 years
3+ years

13. What type of sex did you have with this man? Select all that apply:
    Options: I gave oral sex
    I received oral sex
    Receptive anal sex (I was on the bottom)
    Penetrative anal sex (I was on the top)
    Mutual masturbation
    Other sexual contact

14. Did you use a condom when you had sex with this man?
    Options: Yes
    No

15. Did you plan or think about discussing condom use prior to engaging in sex with this man?
    Options: Did not think about it
    Gave it some thought
    Had a clear plan about this

16. Did you discuss condom use with this man before having sex?
    Options: Yes
    No

17. How easy or difficult was it to discuss the use of a condom with this man?
    Options: Very difficult
    Somewhat difficult
    Somewhat easy
    Easy
    Very easy

18. Were you intoxicated or high when you had sex with this man?
    Options: Yes
    No

    IF YES

    19. How intoxicated or high were you when you had sex with this man (0-7 scale)

20. Was this man intoxicated or high when you had sex with him?
    Options: Yes
    No

IF YES

21. How intoxicated or high did this man seem to you when you had sex with him? (0-7 scale)

22. Did you know this man's HIV and STI status before having sex?
    Options: Yes
    No

23. What as this man's HIV status?
    Options: Unknown
    Negative
    Positive

24. Did you have sex with a second man last night?
    Options: Yes
    No

IF YES

25. Which of the following terms best describes your relationship with this man?
    Options: Anonymous (he and I just met)
    Casual (we have sex sometimes)
    Regular (we have sex frequently)

26. How long have you known this man?
    Options: We met yesterday
    Less than a week
    1-3 weeks
    A month
    2-3 months
    4-6 months
    6-12 months
    1 year
    2-3 years
    3+ years

27. What type of sex did you have with this man? Select all that apply:
    Options: I gave oral sex
    I received oral sex
    Receptive anal sex (I was on the bottom)
    Penetrative anal sex (I was on the top)
    Mutual masturbation
    Other sexual contact

28. Did you use a condom when you had sex with this man?
    Options: Yes
    No

29. Did you plan or think about discussing condom use prior to engaging in sex with this man?
    Options: Did not think about it
    Gave it some thought
    Had a clear plan about this

30. Did you discuss condom use with this man before having sex?
    Options: Yes
    No

31. How easy or difficult was it to discuss the use of a condom with this man?
    Options: Very difficult
    Somewhat difficult
    Somewhat easy
    Easy
    Very easy

32. Were you intoxicated or high when you had sex with this man?
    Options: Yes
    No

    IF YES

    33. How intoxicated or high were you when you had sex with this man (0-7 scale)

34. Was this man intoxicated or high when you had sex with him?
    Options: Yes
    No

    IF YES

    35. How intoxicated or high did this man seem to you when you had sex with him? (0-7 scale)

36. Did you know this man's HIV and STI status before having sex?
    Options: Yes
    No

37. What as this man's HIV status?
    Options: Unknown
    Negative
    Positive

38. Did you have sex with a woman last night?
    Options: Yes
    No

IF YES

39. Which of the following terms best describes your relationship with this woman?
    Options: Anonymous (she and I just met)
    Casual (we have sex sometimes)
    Regular (we have sex frequently)

40. How long have you known this woman?
    Options: We met yesterday
    Less than a week
    1-3 weeks
    A month
    2-3 months
    4-6 months
    6-12 months
    1 year
    2-3 years
    3+ years

41. What type of sex did you have with this woman? Select all that apply:
    Options: I gave oral sex
    I received oral sex
    Vaginal sex
    Mutual masturbation
    Other sexual contact

42. Did you use a condom when you had sex with this woman?
    Options: Yes
    No

43. Did you plan or think about discussing condom use prior to engaging in sex with this woman?
    Options: Did not think about it

Gave it some thought
Had a clear plan about this

44. Did you discuss condom use with this woman before having sex?
    Options: Yes
    No

45. How easy or difficult was it to discuss the use of a condom with this woman?
    Options: Very difficult
    Somewhat difficult
    Somewhat easy
    Easy
    Very easy

46. Were you intoxicated or high when you had sex with this woman?
    Options: Yes
    No

    IF YES

    47. How intoxicated or high were you when you had sex with this woman (0-7 scale)

48. Was this woman intoxicated or high when you had sex with her?
    Options: Yes
    No

    IF YES

    49. How intoxicated or high did this woman seem to you when you had sex with her? (0-7 scale)

50. Did you know this woman's HIV and STI status before having sex?
    Options: Yes
    No

51. What as this woman's HIV status?
    Options: Unknown
    Negative
    Positive

52. Did you use any dating or hook-up apps last night?
    Options: Yes
    No

IF YES

53. Which dating or hook-up app(s) did you use last night? Please select all that apply:
    Options: Bumble
    Coffee Meets Bagel
    Hinge
    OKCupid
    The League
    Tinder
    Chappy
    Grindr
    Growlr
    Hornet
    Jack'd
    Recon
    Scruff

54. Do you plan to have sex later today?
    Options: YES
    NO
    Maybe

IF YES

55. Do you plan to have condoms available if you have sex later today?
    Options: Yes
    No

Appendix G: Evening Survey Questions

1. Where are you?
   Options: Home
   Work
   School
   Recreational place
   Bar or club
   Restaurant
   Friend or relative's home
   In transit
   Other

2. Who are you with?
   Options: I am alone
   I am with a romantic partner
   I am with my family
   I am with friend(s)
   I am in a social setting with people I know
   I am in a social setting with people I don't know
   Other

3. Have you had any alcohol today?
   Options: Yes
   No

   IF YES

   4. How many standard drinks have you had today? As a reminder, a standard drink is (1) a 12-oz bottle or can of beer, (2) a 5-oz glass of wine, or (3) a 1.5-oz shot of a higher proof liquor (free response)

   5. How long did it take you to drink those drinks? (free response)

   6. How intoxicated are you right now? (0-7 scale)

7. Have you taken any drugs today?
   Options: Yes
   No

   IF YES

   8. Which drugs did you use last night?

Options: Cannabis (marijuana, pot, grass, hash, etc.)
Cocaine (coke, crack, etc.)
Prescription stimulants (Ritalin, Concerta, Dexedrine, Adderall, diet pills, etc – ONLY if they were not prescribed to you)
Methamphetamine (speed, crystal meth, ice, etc.)
Inhalants (nitrous oxide, poppers, glue, gas, paint thinner, etc.)
Sedatives or sleeping pills (Valium, Serepax, Ativan, Xanax, Librium, Rohypnol, GHB, etc. – ONLY if they were not prescribed to you)
Hallucinogens (LSD, acid, mushrooms, PCP, Special K, ecstasy, etc.)
Street opioids (heroin, opium)
Prescription opioids (fentanyl, oxycodone [Oxycontin, Percocet], hydrocodone [Vicodin], methadone, buprenorphine, etc. – ONLY if they were not prescribed to you)
Other

9. How high are you right now? (0-7 scale)

10. How sexually aroused are you right now? (0-7 scale)

11. How horny are you right now? (0-7 scale)

12. Are you planning to have sex tonight?
Options: Yes
No
Maybe

IF YES

13. How likely are you to use a condom tonight? (0-7 scale)

14. Are you using a dating or hook-up app right now (or within the last 30 minutes)?
Options: Yes
No

IF YES

15. Which dating or hook-up apps have you been using? Select all that apply:
Options: Bumble
Coffee Meets Bagel

Hinge
OKCupid
The League
Tinder
Chappy
Grindr
Growlr
Hornet
Jack'd
Recon
Scruff

Imagine that you are about to have sex with a casual partner who wants to have sex with you. A casual partner is someone who are you NOT in an exclusive relationship with, but who you have sex with on an occasional or regular basis. Please answer the following questions based on how you are feeling RIGHT NOW:

16. Given the choice, would you prefer to USE or NOT USE a condom with your Partner?
    Options: I would use a condom
    I would NOT use a condom

17. How important would it be to use a condom with your partner? (0-7 scale)

18. How much do you feel you should use a condom with your partner? (0-7 scale)

19. How concerned are you about the potential consequences of having sex without a condom? (0-7 scale)

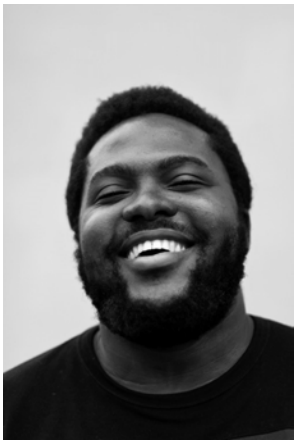
20. How motivated are you to insist on condom use with your partner? (0-7 scale)

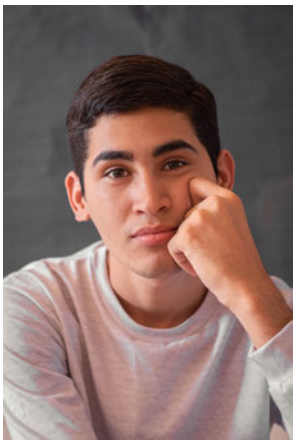
21. If your partner doesn't want to use a condom, would you insist on condom use or go along with what your partner wants?
    Options: I would insist on condom use
    I would go along with what my partner wants

Effort Discounting Task

Imagine that you are planning to have sex with a new partner (pictured below). You've chatted with him a few times and like his personality. You believe that sex with him will be fun and enjoyable.

Example photos:





22. Please take a look at his picture. How attractive do you find him? (0-7 scale)

Imagine that he is coming over to your home tonight. **He will arrive in 2 hours**. After cleaning up your room, you realize that you don't have any condoms. You don't know whether he wants to use condoms, whether he has been recently tested for STIs, whether he is on PrEP, or whether he has had sex with multiple recent partners.

Please answer the following questions about how much effort you might expend to get condoms before he comes over. For each question, you'll be asked to indicate on a 0-100 scale how likely you would be to expend the specified amount of effort to get condoms, with 0 meaning that you definitely **WOULD NOT** expend that amount of effort and 100 meaning that you definitely **WOULD** expend that amount of effort.

Remember, your partner is coming over in 2 hours.

23. How likely are you to spend **ANY** amount of time to get a condom? (0-100 scale)

24. How likely are you to spend up to **5 minutes** to get a condom? (0-100 scale)

25. How likely are you to spend up to **10 minutes** to get a condom? (0-100 scale)

26. How likely are you to spend up to **30 minutes** to get a condom? (0-100 scale)

27. How likely are you to spend up to **45 minutes** to get a condom? (0-100 scale)

28. How likely are you to spend up to **60 minutes** (1 hour) to get a condom? (0-100 scale)

29. How likely are you to spend up to **120 minutes** (2 hours) to get a condom? (0-100 ‘; scale)

Condom Discounting Task

Imagine that you are planning to have sex with a new partner (pictured below). You've chatted with him a few times and like his personality. You believe that sex with him will be fun and enjoyable.

Example photos:

30. Please take a look at his picture. How attractive do you find him? (0-7 scale)

31. Imagine that a condom is immediately available. Using the response scale below, please indicate your likelihood of using that condom when you have sex with this partner, from "I will definitely have sex with this person WITHOUT a condom" to "I will definitely have sex with this person WITH a condom". (0-100 scale)

For the next set of questions, please imagine that you could have sex with this person immediately WITHOUT a condom, or you could wait a period of time to have sex WITH a condom. For each question, please indicate how likely you would be to wait the specified period of time to have sex with a condom, with 0% meaning that you definitely WOULD NOT wait (i.e., you would have sex without a condom right now), and 100% meaning that you definitely WOULD wait (i.e., you would wait in order to have sex with a condom). Please slide the scale to indicate where you answer would fall between 0% and 100%.

32. How likely are you to wait **10 minutes** to have condom protected sex with this partner? (0-100 scale)

33. How likely are you to wait **20 minutes** to have condom protected sex with this partner? (0-100 scale)

34. How likely are you to wait **1 hour** to have condom protected sex with this partner? (0-100 scale)

35. How likely are you to wait **2 hours** to have condom protected sex with this partner? (0-100 scale)

36. How likely are you to wait **4 hours** to have condom protected sex with this partner? (0-100 scale)

37. How likely are you to wait **24 hours** to have condom protected sex with this partner? (0-100 scale)

38. How likely are you to wait **3 days** to have condom protected sex with this partner? (0-100 scale)

39. How likely are you to wait **7 days** to have condom protected sex with this partner? (0-100 scale)

Monetary Equivalence Task

Imagine that you are facing a choice: you can either (1) complete a short job to earn some money, or (2) have condomless anal intercourse (i.e., bareback sex) with the partner pictured below. For the purposes of this set of questions, imagine that you know there is NO RISK of contracting HIV or any other STIs from this partner.

Example photos:

40. Please take a look at his picture. How attractive do you find him? (0-7 scale)

For the next set of questions, please indicate how likely you would be to choose to have condomless anal intercourse rather than the short job to earn some money. For each question, you'll be asked to indicate on a 0-100 scale how likely you would be to choose to have condomless anal intercourse, with 0 meaning that you would definitely take the job and 100 meaning that you would definitely have condomless anal intercourse.

41. How likely are you to choose to have condomless anal intercourse rather than earn **$1?**

42. How likely are you to choose to have condomless anal intercourse rather than earn **$10?**

43. How likely are you to choose to have condomless anal intercourse rather than earn **$25?**

44. How likely are you to choose to have condomless anal intercourse rather than earn **$50?**

45. How likely are you to choose to have condomless anal intercourse rather than earn **$75?**

46. How likely are you to choose to have condomless anal intercourse rather than earn **$100?**

47. How likely are you to choose to have condomless anal intercourse rather than earn **$250?**

48. How likely are you to choose to have condomless anal intercourse rather than earn **$500?**

49. How likely are you to choose to have condomless anal intercourse rather than earn **$1000?**

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