A Mixed-Methods Examination of The Relationship Between Alcohol Intoxication and Sexual Risk Behavior in Men Who Have Sex with Men

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Abstract

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HIV continues to be a serious public health concern among men who have sex with men (MSM). Experimental research suggests that alcohol has a causal role in increasing sexual risk behavior relevant to HIV and STI exposure among men who have sex with men (MSM). However, event-level research has provided mixed results, suggesting that alcohol does not affect sexual risk behavior for all individuals in all circumstances. Qualitative research has found that MSM generally perceive alcohol to increase engagement in sexual risk behavior but has provided limited insight into what factors moderate this effect. Guided by the Inhibition Conflict Model of Alcohol Myopia (ICM), and the Dual Control Model of Sexual Response (DCM), two studies explore the event-level effects of alcohol on sexual risk behavior in a cross-sectional sample of MSM (N=464). In study 1, a subsample of *N*=26 participants completed qualitative interviews on

their perceptions of alcohol's effects on sexual risk behavior. Interview transcripts were coded using thematic analysis and themes were identified. Participants who perceived an effect of alcohol (N=11) identified many sexual risk behaviors that alcohol affected (i.e., condom use, communication with partners, partner selection, etc.) and perceived alcohol to diminish their inhibitions related to STIs. They also indicated that alcohol would be more likely to impact sexual risk decisions with new sexual partners because these partners are perceived as riskier. Participants who perceived no effects of alcohol (N=15) generally reported they used alcohol in moderate amounts or were unconcerned about STI risk and would therefore engage in the same sexual risk behavior whether they were drunk or sober. In study 2, event-level data from N=1049 sexual encounters were assessed using a series of generalized hierarchical linear regressions. Alcohol use showed inconsistent associations with sexual risk behaviors in the full sample but was consistently positively associated with sexual risk behavior for participants who did not use PrEP or were living with HIV and did not currently have an undetectable viral load. Further exploratory analyses indicated that for PrEP non-users, presence of inhibition conflict (i.e., simultaneously high sexual sensation seeking and concerns about HIV/STIs) moderated the relationship between alcohol use and sexual risk behaviors, with those indicating greater inhibition conflict showing stronger effects. Results of the two studies are discussed in the context of the limited research on the ICM and future directions for MSM-focused sexual health research integrating the ICM and DCM.

Table of Contents

A Mixed-Methods Examination of The Relationship Between Alcohol Intoxication and HIV Risk in Men Who Have Sex with Men

General Introduction

One of the greatest public health crises in recent decades is the ongoing global Human Immunodeficiency Virus (HIV) pandemic. HIV has disproportionately impacted men who have sex with men (MSM), with MSM accounting for 70% of new HIV diagnoses in the United States in 2021 (CDC, 2023a). The primary mode of HIV transmission for MSM is condomless anal sex (CAS), and while past efforts to increase condom use among MSM have been successful, condom use has diminished in recent years (Paz-Bailey et al., 2016). This is true even among those who do not use other HIV prevention methods such as pre-exposure prophylaxis (PrEP; Goodreau et al., 2024). It is estimated that about 13 million HIV-negative MSM in the United States (approximately 1 in 3) would significantly reduce their risk of HIV by using PrEP (Bates et al., 2021), but only about 30% of these MSM are currently prescribed PrEP (CDC, 2023b). Because so much of the MSM population remains at risk for HIV, it remains important to understand factors that contribute to CAS in this population, such as alcohol and substance use.

Alcohol and Condomless Anal Sex in MSM

There is robust experimental evidence for alcohol's direct causal effect on increased likelihood of condomless sex in heterosexual populations (George, 2019; George et al., 2024) and among MSM (Maisto et al., 2012; Shuper et al., 2017). However, while experimental studies prove it is *possible* for alcohol to directly cause CAS, evidence for whether alcohol *does* cause CAS in real-world situations is mixed. Cross-sectional and event-level research on alcohol use and sexual behavior among MSM generally finds that alcohol increases likelihood of CAS, but not for all individuals in all circumstances (Maisto & Simons, 2016). Similarly, qualitative

research has generally found that MSM perceive alcohol intoxication to have an effect on condom use, while some report they have not observed an effect in their own life (Adams & Neville, 2009; Mullens et al., 2009; Mutchler et al., 2014; Vagenas et al., 2017).

The Inhibition Conflict Model and Condomless Sex

The Inhibition Conflict Model (ICM) of alcohol myopia (Steele & Southwick, 1985) provides a useful framework for understanding when and for whom alcohol may increase likelihood of CAS. The ICM is a specified model of Alcohol Myopia Theory (AM; Steele & Josephs, 1990) which postulates that alcohol intoxication narrows attentional focus toward impelling cues (i.e., "go" signals) and away from inhibiting cues (i.e., "stop" signals) for a variety of risk behaviors. While AM was developed to explain the effects of alcohol intoxication on risk behavior broadly, the ICM was developed to specify how AM can have an impact on risk behavior in some situations but not others. Both AM and ICM have since been adopted in sexual behavior research to understand the public health impact of alcohol on sexual risk behavior and its relevant outcomes (i.e., HIV, STIs, unintended pregnancies (George, 2019).

The ICM suggests alcohol has the greatest effect on sexual risk behavior when a person is conflicted due to simultaneous high instigation and high inhibition. Instigation factors are dispositional or situational factors that elevate motivation to engage in sex, such as sexual arousal, while inhibition factors are dispositional or situational factors that diminish motivation to engage in sex, such as situational danger or concerns about negative consequences. Figure 1 demonstrates how, according to the ICM, alcohol will have the greatest impact on sexual behavior when instigation and inhibition factors are both elevated. For instance, in scenarios where sexual instigation is high (e.g., a person is very sexually aroused) but inhibition is low (e.g., the sexual behavior is not perceived as risky), a person is likely to have sex regardless of

whether they are intoxicated. If sexual instigation is low, the person will not be motivated to have sex regardless of the level of inhibition. However, if both instigation and inhibition are high, alcohol myopia would lead the person to ignore the inhibiting cues (e.g., potential negative consequences) while selectively attending to instigating cues (e.g., sexual arousal).

The Present Study

The present study seeks to examine the relationship between alcohol and CAS among MSM, with a focus on potential moderating factors, utilizing a mixed-method qualitative and quantitative approach. First, a series of qualitative interviews (N=26) seek to examine MSM's perceptions of alcohol's effects on their sexual behavior and decision making. The research questions guiding qualitative analyses were developed based on the ICM, and include: 1) In what ways do participants perceive alcohol to have an impact on sexual behaviors relevant to HIV and STI risk (i.e., condom use, PrEP use, etc.)? 2) What are the inhibition factors that alcohol diminishes? 3) In what ways do participants perceive alcohol to have no significant impact on their sexual behavior? and 4) What are the individual and situational factors that determine whether alcohol has an impact on sexual behavior? Answers to these questions will allow for a more precise understanding of when and for whom alcohol has an impact on sexual risk behavior relevant to HIV, which will aid in the development and implementation of more targeted individual and population-level research and interventions.

Second, results of a quantitative cross-sectional survey (N=464) will examine the effects of alcohol intoxication and chemsex on sexual behavior across recent sexual experiences. These analyses are informed by the qualitative interviews' findings and by existing event-level research on substance use and CAS among MSM. Analyses will specifically explore the interaction of alcohol intoxication with personality-level and situation-level instigation and inhibition factors.

As predicted by the ICM, alcohol should show the strongest effects on sexual behavior when both inhibition and excitation factors are elevated. The study has received approval from University of Washington's Institutional Review Board (STUDY00013950; approved 9/13/2021).

	Low Instigation	High Instigation
Low Inhibition	No Alcohol Effect: Drunk or not, no one has sex	No Alcohol Effect: Drunk or not, everyone has sex
High Inhibition	No Alcohol Effect: Drunk or not, no one has sex	Alcohol Effect: Only the drunk people have sex

Figure 1. Depiction of the Inhibition Conflict Model (ICM)

Sexual Minority Men's Perceptions of Alcohol's (Lack of)

Effect on Sexual Risk Behavior

Paper 1

Abstract

Experimental research suggests that alcohol has a causal role in increasing sexual risk behavior relevant to HIV and STI exposure among men who have sex with men (MSM). However, event-level research has provided mixed results, suggesting that alcohol does not affect sexual risk behavior for all individuals in all circumstances. Qualitative research has found that MSM generally perceive alcohol to increase engagement in sexual risk behavior but has provided limited insight into what factors moderate this effect. The current study sought to explore ways in which alcohol affects sexual risk behavior in MSM and identify potential moderating factors. Qualitative interviews were conducted with *N*=26 MSM who reported frequent casual sex and alcohol use. Interview transcripts were coded using thematic analysis and three main themes were identified. Participants who perceived an effect of alcohol (N=11) identified many sexual risk behaviors that alcohol affected (i.e., condom use, communication with partners, partner selection, etc.) and perceived alcohol to diminish their inhibitions related to STIs. They also indicated that alcohol would be more likely to impact sexual risk decisions with new sexual partners because these partners are perceived as riskier. Participants who perceived no effects of alcohol (N=15) generally reported they used alcohol in moderate amounts or were unconcerned about STI risk and would therefore engage in the same sexual risk behavior whether they were drunk or sober. Results indicate that future research should focus on sexual risk behaviors beyond condomless sex and should explore moderating factors like partner familiarity and concern about STIs.

There is a notable discrepancy between experimental and event-level research when it comes to the effects of alcohol intoxication on sexual risk behavior among men who have sex with men (MSM; Maisto & Simons, 2016). Experimental research shows strong evidence for an effect of alcohol intoxication on condomless sex (Maisto et al., 2012; Shuper et al., 2017), while the event-level research reports mixed findings (Maisto & Simons, 2016). It is therefore especially important to understand the factors that may moderate the effect of alcohol on sexual risk behaviors. Thus, at this early exploratory stage in the research, qualitative methods may be well suited to identify moderating mechanism for further study. The inhibition conflict model may provide a framework for investigating such moderators (i.e., inhibition and instigation factors), but no research to date has explored potential moderators while guided by this theoretical framework.

Qualitative Research on Alcohol and Sexual Risk Behavior among MSM

Qualitative studies examining the effect of alcohol intoxication on HIV risk among MSM have largely found that MSM perceive alcohol to increase the likelihood of engaging in condomless sex. Men in these studies report that when they are intoxicated, they are more likely to have sex without a condom (Adams & Neville, 2009; Mutchler et al., 2014; Rhodes et al., 2011; Shuper et al., 2022; Vagenas et al., 2017; VanDevanter et al., 2011), and will be more likely to have sex with a partner that they may not have found attractive when sober (Mullens et al., 2009; Vagenas et al., 2017). In three studies, a subset of participants described limited effects of alcohol on condomless sex, though these participants were in the minority in their respective samples (Mullens et al., 2009; Mutchler et al., 2014; Parsons et al., 2004). These participants stated that they did not drink concurrently with sex, were unable to maintain an erection when drunk (Mullens et al., 2009), and continued to use condoms even when intoxicated (Mutchler et

al., 2014). Parsons et al., (2004) described some individuals for whom alcohol lead to spontaneous (i.e., unplanned) sexual encounters. Many of these individuals stated that they were able to use a condom regardless of how intoxicated they were, and the authors suggested that these individuals had effectively integrated condom use behaviors into their sexual scripts.

While qualitative research has explored MSM's perceptions of *whether* alcohol has an effect on sexual risk behavior, it has largely ignored the question of *when and why* it has an effect. The few studies that have addressed this question have quoted participants' descriptions of the "disinhibiting effects" of alcohol without clarifying which inhibitions alcohol effects. (Mutchler et al., 2014; VanDevanter et al., 2011). However, three studies that focused on Black and Latino MSM did discuss how alcohol may interact with minority stress and stigma to increase sexual risk. Rhodes et al. (2011) noted that white participants considered alcohol a risk factor for engaging in condomless anal sex, while Black and Latino participants discussed alcohol as an "excuse" for engaging in this behavior, or a post-hoc justification for willingly engaging in a stigmatized behavior (i.e., sex between men, sex that is a known risk for spreading HIV). VanDevanter et al. (2011) and Parsons et al. (2004) identified similar themes in samples of Black and Latino MSM, and Parsons et al. (2004) specifically discussed how drinking alcohol reduces inhibitions around high-risk sexual behaviors that are highly stigmatized by society (i.e., having condomless anal sex when knowingly HIV-positive). These studies therefore suggest that in these racial minority MSM communities, alcohol may disinhibit distal minority stress factors that would otherwise inhibit sexual risk behavior.

Finally, other qualitative studies have investigated the relationship between alcohol, HIV prevention (i.e., PrEP use), and treatment (i.e., HIV medication adherence). Storholm et al. (2017) found that for some participants, alcohol use interfered with adherence to PrEP, with day

drinking, hangovers, and disruptions to routine leading to missed doses. However, another study found that participants largely reported third-person effects, describing how alcohol use does not affect their own PrEP use, but that problematic alcohol use could theoretically affect someone else's PrEP adherence (Shuper et al., 2022). Another study found that participants utilized PrEP as a "safety net" to protect them from HIV if they failed to use a condom when drunk or intoxicated with drugs. Finally, a review of the qualitative literature on HIV treatment adherence found that alcohol use is commonly identified as a cause of non-adherence for anti-retroviral treatment among HIV-positive MSM (Vervoort et al., 2007).

Limitations of Current Qualitative Research

Despite the limited number of studies, current qualitative research indicates that most MSM perceive alcohol to increase likelihood of condomless sex. This is in line with experimental, but not event-level research on alcohol effects, and represents another discrepancy in the literature. However, qualitative studies have not explicitly and rigorously assessed for examples of alcohol non-effects or explored moderating factors (i.e., inhibitions) that may explain the mixed results of event-level research. While some studies have discussed the potential moderating role of stigma and minority stress on condomless sex, this has not been explored in great detail.

The existing literature also primarily focuses on alcohol's effect on condomless anal sex. In the past decade, PrEP use and treatment as prevention (TasP) have become common HIV risk-mitigation strategies among MSM and represent other sexual risk behaviors for alcohol to effect. While existing studies suggest that alcohol use may interfere with medication adherence, no studies to date have investigated other ways alcohol may affect sexual risk behavior related to PrEP and TasP, such as asking potential partners about their PrEP use or HIV viral load, or their

use of on-demand (2-1-1) PrEP for sexual encounters. In addition, sexual risk behaviors that have been explored in the quantitative literature, such as the decision to have anal sex with a partner (whether a condom is used or not; Kahler et al., 2015) and condom negotiation (Wray et al., 2019), have not been explored in qualitative studies. The lack of exploration in this area may mean that researchers are unaware of relevant sexual risk behaviors that alcohol may affect in this population.

Current Study

Guided by Alcohol Myopia Theory and the Inhibition Conflict Model, the present study seeks to identify the moderating impact of inhibition factors on the relationship between alcohol intoxication and sexual risk behavior among MSM using a qualitative interview design. Qualitative interview methods are flexible in their approach to both data collection and analysis, allowing for researchers to both to gather evidence for predetermined hypotheses (i.e., deductive approaches) and identify emergent findings that may be unexpected (i.e., inductive approaches; Banister et al., 2011). Thus, these methods could prove useful in identifying when and for whom alcohol has an effect on sexual risk behavior, including both factors predicted by a theoretical framework (i.e., ICM) and factors that emerge from the data.

The present study analyzes qualitative interviews conducted with MSM who report engaging in frequent CAS and heavy episodic drinking. Analyses will seek to identify perceptions of how alcohol does and does not affect sexual risk behavior, as well as specific inhibition factors that may serve as moderating factors for alcohol's effects. Qualitative analyses will utilize a combined deductive and inductive approaches to thematic analysis (Braun & Clarke, 2021), searching for themes described in previous research while allowing for the identification of new themes emerging from the data.

Methods

Participants and Recruitment

Participants who completed an online quantitative survey and indicated they were interested in participating in an interview were contacted via email or text message and invited to complete a qualitative interview. Recruitment was purposive, focusing on recruiting participants reporting frequent sexual behavior, recent sexual behavior while intoxicated with alcohol, frequent alcohol use, and recent condomless sexual activity. In addition, efforts were made to recruit participants with diverse demographic characteristics, including age, race, and sexual identity, as well as participants with a diverse range of HIV risk factors, including both HIV positive and negative participants, HIV-positive participants with undetectable and detectable viral loads, and HIV-negative who used a variety of PrEP modalities (i.e., daily, 2-1-1, long-acting) and did not use PrEP. Participants were purposively excluded from recruitment if there was indication of survey fraud (i.e., failing attention check and validity check questions on the survey) or if they reported recent chemsex (to prevent symptoms of other substance use disorders from impacting the examination of alcohol's effects).

A total of N=65 participants were invited to complete an interview, and of these participants, N=27 completed interviews. Participant pseudonyms and interview characteristics are displayed in Table 1, and descriptive statistics of demographic factors for this sample are displayed in Table 2. Despite efforts to avoid recruitment of participants with active chemsex use and substance use disorders, four participants reported regular use of methamphetamine with sexual encounters (see Table 1).

Procedure and Measures

The qualitative interview was a semi-structured individual interview conducted on Zoom with the study PI. Participants requesting an interview over the phone were given instructions to call into the private Zoom meeting. All interviews were conducted in English, and interviews lasted for approximately 50 minutes to 1 hour and 20 minutes. All interviews were audio recorded with Zoom's recording feature.

The interviews began with a review of informed consent, an overview of the topics that would be covered, and an opportunity for participants to address any questions or concerns. Participants were first asked to confirm demographic information provided in the survey, including age, racial/ethnic identity, geographic location, relationship status, and sexual orientation. Participants were then asked to describe their use of alcohol and other substances, including the typical frequency and settings of use, as well as any associated problems. Next, participants were asked about their partnered sexual behaviors and their perceptions of STI risk for these behaviors. They were specifically asked about risk mitigation strategies for HIV including condom use and PrEP, and they were asked to clarify why they do or do not use these strategies. Participants were then asked about how alcohol and other substance use relates to their sexual behavior, specifically probing for perceived effects of alcohol and other substance intoxication on HIV risk mitigation strategies.

Analyses

Qualitative Analysis Team

The PI identifies as a graduate student in psychology with vested research interests in the sexual and mental health of sexual minority individuals and in sexual behavior broadly. In particular, he identifies with a sex-positive approach to treating health concerns related to sexual behavior and in harm-reduction strategies to approach behavior change with high-risk behaviors.

The PI also identifies himself as a member of a segment of the LGBTQ+ community at elevated risk for HIV, and as an advocate for safe and healthy sexual enjoyment. Other study team members that transcribed and coded the data include psychology graduate students who study sexual behavior and substance use and undergraduate and non-student volunteer research assistants.

Interview Transcription

Initial transcription of interviews was automated using the transcription feature on Zoom. Automated transcriptions were reviewed, formatted, and corrected by at least two research assistants and the PI based on the original recording. Identifying information including names, geographic locations, and location-specific features (i.e., sports teams or bar names) were removed from transcripts to preserve anonymity.

Codebook Development

The codebook for analyses was developed using both deductive and inductive approaches. First, relevant categories of codes were identified based on research questions related to the ICM and HIV risk, including "alcohol affects sexual risk behavior" and "alcohol affects inhibition factors." After completing the first 9 interviews, the study PI developed a preliminary codebook. The PI reviewed notes and summaries of the interviews to begin identifying specific codes that were described by participants in the interviews. He also identified theory-derived codes that had not yet been mentioned by participants, as well as populations and HIV risk profiles that were underrepresented in the participants up to that point (i.e., HIV positive participants, HIV-negative participants not currently using PrEP). Awareness of these gaps then guided purposive recruitment and led to additional questions/probes being added to the

interview guide. After completing all interviews, the primary author again reviewed summaries of interviews and interview notes to identify additional themes and categories of themes.

Interview Coding

Interview transcripts were coded using Atlas.ti (version 24). All interviews were coded by the study PI, with approximately 30% of interviews (N=8) being co-coded by research assistants. Research assistants first received training on the codebook and coded two interviews independently. The coding team met to compare codes for these two interviews and provide feedback, and research assistants then coded three additional interviews each. In team meetings, the PI and research assistants reviewed all discrepancies in codes and discussed potential changes to coding or codebook to address these discrepancies.

At all points throughout the coding process, the codebook was revised to accommodate emergent codes and to clarify discrepancies in coding. The code "other notable response" was used to identify important themes that had not yet been identified in the codebook, and this code was reviewed to identify potential emergent codes. Codes that were commonly co-coded, such as "prior communication" and "partner screening," were revised to clarify their differences. In addition, codes that were deemed irrelevant to the research questions (i.e., alcohol's effects on digestive issues relevant to bottoming) were removed from the codebook. After each revision to the codebook, the research team reviewed previously coded interviews to revise coding.

Identification of Themes

Analyses of codes were conducted using Atlas.ti (version 24). Queries were run to consolidate quotations for each code, and co-occurrence analyses were conducted to identify codes that had significant overlap. Themes were identified across codes that helped to address

the study's primary research questions, including effects and non-effects of alcohol, and sexual inhibition factors that determine whether alcohol has an effect on sexual behavior.

Participants were also grouped based on whether they reported effects of alcohol on their sexual risk behavior. Participants were either placed into the "alcohol affects sexual risk behavior" group or "alcohol does not affect sexual risk behavior" group. Participants who reported that alcohol affected their sexual behavior during a previous period of life (e.g., in college, or before they became HIV-positive), or that they could hypothetically see alcohol having an effect but did not currently report effects of alcohol on their sexual behavior, they were placed into the "does not affect" group because the interview focused on their current behavior. The groups were compared to determine what differences may explain whether alcohol has an effect on their sexual behavior, including comparing whether certain codes appeared more commonly in one group or the other.

Results

Participant Demographics and Descriptives

A total of N=27 participants completed interviews for the study, though one participant (participant #2) was excluded from transcription and analysis because of evidence they had fraudulently completed the survey. Thus, a total of 26 participant interviews were transcribed and coded (see Table 1). Descriptive statistics of demographics for this sample are displayed in Table 2. Just over half of participants identified as White (N=14; 53.8%), with the remainder representing a variety of racial identities. Over half of participants reported they were HIV-negative and currently use PrEP (N=15; 57.7%), while N=5 participants (19.2%) reported that they were HIV-positive. After grouping participants based on alcohol effects, N=11 participants were placed in the "alcohol affects sexual risk behavior" group and N=15 participants were

placed in the "alcohol does not affect sexual risk behavior" group. Pseudonyms of participants included in each group can be viewed in Table 3.

Theme 1: Alcohol Can Affect a Variety of Sexual Risk Behaviors in a Variety of Settings

Eleven out of 15 participants reported that they perceived alcohol to have an effect on their sexual risk behavior. Some participants described how alcohol makes them less likely to choose to use a condom in the "heat of the moment" during a sexual encounter. These participants described how alcohol caused them to ignore potential negative consequences of condomless sex (i.e., STIs) and focus on what felt good during the sexual encounter.

> *"If we're doing it [while intoxicated] and we're in the living room, I'm not going to the bedroom to get [a condom]. […] I just don't feel like taking the time to do it. I just don't see a point. I'm like, 'well, if I do it now, I can just go get tested in a few days and see.' […] I'm not thinking about the future. I'm thinking about the now."*
>
> (Jack, 24, bisexual, white, daily PrEP user)

Other participant stated that alcohol made them more willing to agree to condomless sex *before* they were in the heat of the moment. These participants described how, when they were drunk and looking for a partner (i.e., on a hookup app), they were more willing to agree to have sex with someone who did not want to use a condom.

> *"I was just rejected over and over and over and over and over again [because he would only have sex with condoms] and was getting very upset and just, you know, low self-esteem and all that. So, I just started getting really drunk and then I was just like, 'fuck it'. Let's do it [i.e., have sex without a condom]."*
>
> (Jordan, 30, gay, white, 2-1-1 PrEP user)

Beyond condom use, other participants descried how alcohol made them more likely to have anal sex with a sexual partner rather than engaging in lower-risk behaviors like oral sex or mutual masturbation.

> *"When it comes to what kind of sex to have, like in terms of just oral versus going over to anal, I would say that there's probably a small impact that alcohol would have in terms of nudging it further. [...] Because if I've decided to do one thing and I consume a little bit of alcohol, then probably I'll be suggestible to doing more."*
>
> (Josh, 28, gay, white, daily PrEP user)

One participant described how alcohol makes him more willing to let new partners ejaculate inside him when he bottoms.

> *"I definitely like when guys cum in me, but there's sometimes where I would rather them not. Like if it's somebody I met for the first time. And there are times where I drink or I'm on other drugs and I'm like, 'yeah, cum in me' [laughs]. Like, I don't care, those inhibitions kind of go down."*
>
> (Diego, 36, gay, Latino, daily PrEP user)

Though many participants discussed alcohol's effects on condom use and anal sex, the most commonly discussed alcohol effect was its effect on the screening of new sex partners. Many participants described how prior to agreeing to have sex with someone, they would ask them about their STI status and PrEP use or screen their hookup app profile for this information. Many participants had specific policies about who they would have sex with (i.e., only if a partner has been recently tested, is on PrEP, is undetectable, etc.), and this screening process would help them determine whether a potential partner met their criteria. For many of these

participants, alcohol made them more likely to forgo this screening process or to ignore "red flags" that would usually give them pause.

> *"On Halloween [when I was drunk] I had a guy come over and it wasn't until the morning after - I woke up and I'm like, 'wait, I just got his pictures. I didn't even see his status or even ask him for his status.' I'm like, 'Crap. Why didn't I check? Why didn't I ask?' […]*
>
> (Diego, 36, gay, Latino, daily PrEP user)

One participant who was in an open relationship described how he would typically screen new partners with his romantic partner, and they would decide together whether to have sex with the person. He described an experience where alcohol intoxication led both him and his partner to forgo this screening process.

> *"[My partner] brought someone over [while we were drunk] and I didn't really say 'okay,' but then when he was here, I was just like, 'eh, you're good looking like let's go for it.' If I were sober, I would be like, 'what the fuck?'"*
>
> (Antonio, 31, gay, Latino, daily PrEP user)

Other participants described how alcohol interfered with their ability to ensure a condom would be available for the sexual encounter. These participants discussed how when they were drunk, they would be more likely to jump right into sexual activity without first making sure a condom is available. Sober, they would either ask their partner to provide a condom or find one themselves.

> *"I'm more prone to be adamant about condom usage if I'm not drinking. Because I'm probably not like heated or aroused as much as I would be if I've been drinking. […] Sober, I'm gonna ask, whether texting or in person, 'are you okay with condoms? Do you*

have any kind of condom?' If they don't have any kind of condoms, I'll say like, 'I'll bring them or I'll stop to get some.'"

(Jerome, 33, gay, Black, daily PrEP user)

Participants also discussed how alcohol affected their decision to seek out a sexual partner. Several described how alcohol intoxication made them more likely to take a first step toward seeking a sexual partner, such as opening a hookup app or going to an in-person venue like a gay bathhouse.

"I think it was two times where I was down at [gay neighborhood] and I drank too much and I went to a bathhouse. And yeah, it's not something I feel like sober me- I wouldn't go to a bathhouse. […] And there it was like... I didn't use a condom, was with multiple people... So, it was really risky."

(Juan, 24, Latino, gay, daily PrEP user)

"[When I'm drinking] I'm more prone to like to seek out short term engagements online. Like I'll use Tinder and Grindr more because those are primarily for hookups and not like long term relationships. Whereas right now I'm not really drinking- I'll use Bumble and go on dates and stuff instead of just like, 'Hey, it's 3:00 in the morning, you want to come over to my house?'"

(Keith, 38, bisexual, white, no PrEP use)

Participants also described experiences where they were not intending to have sex during a night out, but alcohol intoxication led them to impulsively have sex.

"I'm not gonna be like, 'oh, I'm gonna drink and hook up with someone tonight.' I feel like it's more, so I drink and then I'm in a situation that ends up leading into that."

(Nate, 24, bisexual, Latino, daily PrEP user)

Finally, two participants discussed how alcohol and substance use affected their ability to use PrEP. Keith, who up until a few weeks prior to the interview was struggling with a severe alcohol use disorder, described how his alcohol use prevented him from adhering to daily PrEP.

> *"When I was drinking, I couldn't remember to take a pill every day. It just seemed like I was wasting my insurance money on getting it cause I would forget half the days if I was drunk. […] They brought up [long-acting PrEP] at the [sexual health] clinic, and they checked, and my insurance doesn't cover it."*
>
> (Keith, 38, bisexual, white, no PrEP use)

Jordan, on the other hand, reported using on-demand (2-1-1) PrEP. He described an incident where cannabis intoxication interfered with his ability to take this medication at least two hours prior to the sexual encounter.

> *"I took [PrEP] the second I knew something was going to happen, but I did end up having sex within those 2 hours. […] I do wonder if I would have gone through with it had I not been under the influence of cannabis. […] I think one thing that may have influenced it is that this was a person I considered out of my league, so I was just very excited that a person like that would be interested in someone like me."*
>
> (Jordan, 30, gay, white, 2-1-1 PrEP user)

Although this incident involved cannabis rather than alcohol, the effects Jordan describes are very similar to alcohol myopia: intoxication led him to focus on impelling cues (i.e., attractiveness of his partner) and ignore inhibiting cues (i.e., HIV risk). It is therefore conceivable that alcohol could have a similar effect on adherence to on-demand PrEP in situations like this.

Taken together, the experiences of these participants highlight how alcohol can affect a variety of sexual risk decisions in variety of settings. These decisions include whether to use a condom, ensure a condom is available, communicate their preferences to a partner, have sex with a partner, have anal sex with a partner, screen a partner for risk factors, whether to look for a partner in the first place, and adherence to PrEP. These decisions happen during the sexual encounters itself, but also happen before the sexual encounter when the individual is deciding whether to have sex with someone and whether to look for a sexual encounter in the first place.

Theme 2: Alcohol has Limited Effect on Sexual Decision Making for Those who are Unconcerned About STIs

The major distinguishing factor between the "alcohol affects sexual risk behavior" (N=11) and the "alcohol does not affect sexual risk behavior" (N=15) groups was concern about STIs. Concerns about STIs were reported by all 11 participants who reported alcohol effects and only four participants who reported no alcohol effects. Representative quotations from participants in each group about their STI concerns and the effects of alcohol on these concerns are displayed in Table 3.

The 11 participants who reported alcohol effects all reported concerns about the negative health consequences of STIs such as painful symptoms, long-term consequences, or treatment side effects. These concerns were based on firsthand experiences, secondhand experiences of peers, and sexual education they received growing up. Several participants in this group were also very concerned about the stigma associated STIs. Some were concerned about how others, such as romantic partners, sexual partners, or peers, would judge them if they tested positive for an STI. Others discussed negative consequences of past STI diagnoses, such as feeling "dirty" or shameful (i.e., self-stigma), or experiences of rejection from others. Some participants in this

group specifically identified how STI concerns were disinhibited by alcohol, stating that when they are drunk during sexual encounters, concerns about STIs go "out the window."

The 15 participants who reported no alcohol effects generally described a lack of concern about STIs. Most felt they were sufficiently protected from HIV, either by using PrEP or maintaining an undetectable viral load, and that other STIs were easily detectable and treatable. A few participants who were not on PrEP or did not maintain an undetectable viral load also described a lack of concern about STIs. These participants had not personally experienced negative consequences of STIs or described a lack of education about STI risks from healthcare providers or educators. They therefore perceived (inaccurately) that they were at low risk for STIs and that their existing strategies for avoiding STIs were sufficient. A few participants specifically described why they believed alcohol did not affect their sexual risk behavior: because they don't perceive condomless sex to be risky, they behave the same whether they are drunk or sober.

Four participants in the "alcohol does not affect sexual risk behavior" group reported concerns about STIs. However, these four participants differed from participants in the "alcohol affects sexual risk behavior" group in two ways. First, participants were more ambivalent about STI risk and unprotected sex. While some of these participants had first or secondhand experience of negative health consequences of STIs, they also felt that this risk was inherent to being sexually active and were willing to take this risk because they found so much value in their sex life.

> *"I had quite a complication from syphilis last year where it amassed into a tumor in my rectum, which really caused a lot of health issues. So that was very eye opening and scary. […] [STIs are] a worry, but then it does come with the territory of being gay just*

having sex in general and not using protection. And of course, the [city] hookup culture is like, if you put in 'safe' [on your hookup app profile] it's like, 'blocked' right away."

(Brian, 34, gay, white, daily PrEP user)

Second, these participants reported that they typically did not consume enough alcohol prior to sexual encounters to become intoxicated. While they speculated that alcohol could hypothetically affect their sexual behavior, they reported that they intentionally avoid getting intoxicated prior to sexual encounters to avoid these effects on their sexual risk behavior.

"*I do feel like if I were really set to just do oral, if I had a lot to drink, I definitely would be easier to persuade to do more. But it's something that I'm fairly careful with – to not drink too much when it comes to hookups."*

(Todd, 23, gay, Asian, long-acting PrEP user)

Theme 3: Alcohol has a Greater Effect on Sexual Encounters with New Partners Because These Partners are Perceived as Riskier

Nine participants described how they perceive new sexual partners (i.e., hookups or sexual partners they are meeting for the first time) to be higher risk for STIs compared to established sex partners (i.e., partners they have hooked up with before, casual partners, "friends with benefits," etc.). This included participants in both the "alcohol affects sexual risk behavior" and "alcohol does not affect sexual risk behavior" groups. In general, these participants were more risk-averse with new partners, preferring to use condoms or refrain from anal sex. For partners they had met previously or established a friendship with, they were more willing to have anal sex without a condom. However, the point at which a new partner became an established partner differed considerably between participants.

"I do prefer a condom, especially when it's a hookup or like a one-time thing or somebody new. […] Maybe after like the second or third time [we have sex] or you know, after getting to really get to know each other. Then it's okay [to not use a condom]. Like, I trust you and you trust me."

(Jerome, 33, gay, Black daily PrEP user)

"With [anal sex], I if it were to get to that point, it would have to be exclusively only with condoms even if I and the other person are on PrEP. And for that to happen, I've made the decision that it would have to be with someone I would officially make it an exclusive type of relationship."

(Paul, 35, gay, Latino, daily PrEP user)

Many participants, like Jerome, were comfortable having condomless sex with a partner after having sex with them a few times. Paul, on the other hand, represents the opposite end of the spectrum, preferring to only have anal sex with exclusive partners.

Only one participant commented on how alcohol differentially affected his sexual risk behavior with new and established partners.

"If I know you or if you're a consistent person and I know like you're getting tested, you're being safe, then I'm less likely to use [a condom]. Now if it's a one-off situation, it really depends on if we were drinking and how drunk I got before. I will be like, okay, 'I should wear one' or 'too buzzed, just screw it.'"

(Jack, 24, white, bisexual, daily PrEP user)

Though only Jack described these effects, the experiences of other participants align with this pattern. Because sex with a new partner is perceived as riskier and is more likely to involve

condoms and other risk-mitigating behaviors, there are more inhibitions for alcohol to disinhibit and more sexual risk behaviors for alcohol to enable in these encounters.

It is also important to note that while these participants *perceived* established partners to be lower risk than hookup partners, these perceptions may not be accurate. Many participants described how their comfort with established partners was based on assumptions and gut feelings.

> *I just feel more comfortable with somebody I already know. Like I've been knowing you, I've had sex with you… You don't have it [HIV] now unless you are fucking with new people... you probably are, but I would assume you're taking some type of precaution"*
> (Charles, 29, bisexual, Black HIV- and not using PrEP)

> *"When you talk to someone sometimes you can get a sense of if they're someone that maybe hooks up 3 times a year versus someone that is looking to hook up with different people every day [..] Sometimes you have that gut feeling. You'll just be like, okay, maybe I should be more careful or maybe I shouldn't hook up with this person."*
> (Todd, 23, Asian, gay, long-acting PrEP user)

Other participants pointed out the problems with these perceptions about established partners.

> *"I guess when you have been with someone for one or a couple of times before, you don't keep asking the questions that you should be asking about - 'have you tested recently?' or 'Are you having sex with other people who were not taking care of themselves?'"*
> (Eric, 51, gay, Latino, daily PrEP user)

"I suppose like so many people, I'm dumb enough to really think I could tell if someone might be carrying an STI or not."

(Ian, 67, gay, white, HIV+ and undetectable)

These participants highlight how perceived risk for STIs with established partners likely differ from actual risks, and how these misperceptions can lead to risker behavior.

Discussion

Analyses of these qualitative interviews provided a rich description of how MSM perceive alcohol to affect or not affect their decision making around sexual risk. Many participants who reported effects of alcohol described experiences consistent with Alcohol Myopia Theory. Alcohol caused them to attend to sexual excitation cues (i.e., sexual arousal) and prevented them from attending to inhibition cues (i.e., risk of STIs). Participants who reported no effects of alcohol described experiences consistent with the Inhibition Conflict Model. They were unconcerned about the negative consequences of STIs or perceived unprotected sex to be low-risk, and therefore would behave the same whether drunk or sober. These results suggest that inhibition factors – especially concerns about STIs – may moderate the association between alcohol intoxication and sexual risk behavior.

A key takeaway from the first theme is the need to explore the effects of alcohol sexual risk behavior beyond condom use during sexual encounters, which has largely been the focus of experimental and event-level research up to this point (George, 2019). Participants described how alcohol not only affected sexual decisions the "heat of the moment" during a sexual encounter, but also affected several decisions leading up to the sexual encounter, such as making sure a condom is available and deciding whether have sex with a partner who does not want to use a condom. Participants also described many sexual risk behaviors beyond condom use that

were affected by alcohol intoxication, such as the decision to have anal sex, screening a partner for risk factors, and choosing to seek out a partner in the first place. These findings aligns with previous event-level and experimental research indicating alcohol intoxication increases likelihood of having sex with a potential partner (Mustanski, 2008; Wray et al., 2020) and having anal sex (Gleason et al., 2023; Kahler et al., 2015), while it decreases condom negotiation skills (Wray et al., 2019). However, this is the first qualitative study to explore the variety of sexual behaviors alcohol can affect in MSM. There results highlight that while alcohol may not affect someone's decision to use a condom in the heat-of-the-moment, it may affect their sexual risk in other ways before the sexual encounter even starts.

These results also confirm prior research indicating that sexual behavior with new partners is more likely to be affected by alcohol than sexual behavior with established partners (Vanable et al., 2004), and reinforces the field's focus on sexual encounters with new partners (George, 2019). However, they also indicate that greater care is needed in the assessment of partner familiarity in research on MSM. Many event-level studies have distinguished between romantic partners and casual partners, but did not assessed partner familiarity further than this (Kahler et al., 2015; Mustanski, 2008; Newcomb, 2013; Vanable et al., 2004). Participants in this study described complex social networks of sexual partners, and while some stated they could trust a partner enough to have unprotected sex with them after a few meetups, others built up trust by getting to know the partner in a non-sexual setting or establishing a commitment of sexual exclusivity. Other participants were unconcerned about STIs and would have the same condom use policy for all their partners regardless of whether they were new or established.

Finally, it is notable that while many participants perceived established partners to be less risky than new partners, these perceptions were often based on assumptions and inaccurate

indicators. This is in line with previous research indicating MSM tend to perceive sex with regular partners as lower risk for STIs, and therefore are less likely to use condoms (Misovich et al., 1997). It also aligns with research indicating perceptions of STI risk with regular partners tend to be based on unreliable indicators of risk, including attractiveness and emotional safety (Comer & Nemeroff, 2000). These findings highlight that alcohol-focused STI risk interventions may help reduce risk in some settings (i.e., with new partners), it may not be as effective for other settings without helping individuals to re-evaluate how they determine STI risk.

Limitations

Several limitations must be accounted for when interpreting these results. First, the sample for this study was small and was purposively recruited to include only MSM at high risk for STIs who drank alcohol with sex. This limits the generalizability of this study's findings, as the participants are not representative of the larger MSM population. However, this study was intended as an in-depth exploration of potential effects of alcohol and moderation factors that could be later verified by large-scale quantitative research. The in-depth, exploratory nature of qualitative interviews trades generalizability with internal validity and provides an opportunity to uncover factors that have been missing from quantitative research up to this point.

Second, this study explored participants' perceptions of alcohol's effects on their own behavior, and these perceptions are subject to bias, such as hindsight bias and social desirability bias. Thus, participants may have attributed certain decisions to alcohol intoxication when these decisions were actually caused by other factors. On the other hand, participants may have downplayed alcohol's effects misunderstood the effects alcohol was having on them in the moment. Despite this limitation, research on alcohol expectancies has shown that individuals' perceptions of alcohols' effects on their behavior has a strong influence on their behavior when

drinking, even when they are given a placebo non-alcoholic drink in an experimental setting (George et al., 2024). It is therefore important to understand perceptions of alcohol's effects, given that these perceptions will likely have real influence above and beyond the physiological effects of alcohol.

Finally, recruitment for this study was limited to individuals who use hookup applications or who are members of crowdsourcing platforms. In addition, participants who use PrEP or have undetectable viral loads were over-represented in this sample. Though attempts were made to recruit participants who did not use PrEP or were inconsistent with the HIV treatment, these participants were particularly challenging to recruit, or reported behaviors that excluded them from recruitment (i.e., chemsex). It is also notable that of the five participants who were at elevated risk for HIV (i.e., were not using PrEP or were HIV-positive and not undetectable), only one reported effects of alcohol on sexual risk behavior (i.e., Keith) and two reported current methamphetamine use (i.e., Fred and Adam). This study therefore collected limited data on alcohol effects in individuals at very high risk for HIV, and the results of this study may more accurately reflect risk factors for other STIs.

Future Research

Results of this study suggested that STI concerns may be a key factor in determining whether alcohol has an impact on sexual risk behavior. Future quantitative research should therefore attempt to confirm this finding by comprehensively assessing STI concern and including this variable in a moderation model. Such research could help to resolve the discrepancies between experimental and event-level research. However, research may first be needed to properly operationalize the measurement of STI concern, as it is likely a heterogeneous construct. Participants in this study had diverse concerns about STIs, including

concerns related to both health and stigma, and many participants expressed ambivalence about STI risk. Assessment that captures all aspects of STI concerns, both at the personality and event-level, must be developed in order to determine the moderating effects of this factor.

Future quantitative research should also explore ways to more precisely measure partner familiarity among MSM. Like STI risk, this construct is multifaceted and may involve both number of prior encounters as well as perceptions of trust and openness with the partner. Partner familiarity may serve as another important moderating variable in the relationship between alcohol and sexual risk, and thus establishing a clear definition and a valid measurement of this construct is paramount for future research.

Finally, future research, whether quantitative or qualitative, should specifically focus on individuals at high risk for HIV (i.e., those not on PrEP or undetectable) and should separately assess individuals who do and do not currently engage in chemsex. Methods of recruitment for higher-risk populations should be explored and disseminated, as these populations tend to be harder to reach and less willing to participate in research. Efforts to recruit this population and control for extraneous variables like chemsex will allow research to more accurately assess the effects of alcohol on HIV risk in populations that could benefit most from intervention.

Conclusion

This study sought to explore effects of alcohol on sexual risk behavior and factors that may moderate this relationship among MSM. Results confirmed the inhibition conflict model as an important framework for understanding alcohol's effects, and highlighted STI concerns as a key potential moderating factor. Despite limitations in generalizability, this study points to future directions in both qualitative and quantitative research, emphasizing the need for valid measurement and more precise recruitment of high-risk populations.

Table 1: Data Overview

Participant Pseudonym	Age	Sexual Identity	Race	HIV Status/ PrEP use	Interview Date	Length (minutes)	Other Notes
Carlos	24	Bisexual	Latino	Daily PrEP	9/12/23	50	
Brian	34	Gay	White	Daily PrEP	9/15/23	54	
Nate	24	Bisexual	Latino	Daily PrEP	9/18/23	51	
Daniel	33	Gay	White	HIV- No PrEP	9/19/23	46	Reported severe alcohol use disorder
Jack	24	Bisexual	White	Daily PrEP	9/19/23	46	
Josh	28	Gay	White	Daily PrEP	9/22/23	65	
Todd	23	Gay	Asian	Long-acting PrEP	9/26/23	73	
Eric	51	Gay	Latino	Daily PrEP	9/30/23	41	
Keith	38	Bisexual	White	HIV- No PrEP	10/4/23	48	Reported severe alcohol use disorder
Thomas	31	Gay/ Queer	Black	2-1-1 PrEP	10/10/23	61	
Alvaro	30	Gay	Latino	2-1-1 PrEP	10/11/23	53	
David	55	Gay	White	HIV+ and undetectable	10/17/23	67	Reported current chemsex/meth use
Charles	29	Bisexual	Black	HIV- No PrEP	10/24/23	49	
Will	37	Gay	White	Long-acting PrEP	10/24/23	56	Reported past chemsex/meth use
Jordan	30	Gay	White	2-1-1 PrEP	10/25/23	51	
Jerome	33	Gay	Black	Daily PrEP	11/8/23	55	
Fred	43	Bisexual	Multi-racial	HIV- No PrEP	11/10/23	44	Reported current chemsex/meth use
Diego	36	Gay	Latino	Daily PrEP	11/10/23	59	
James	41	Gay	White	2-1-1 PrEP	11/14/23	63	
Antonio	31	Gay	Latino	Daily PrEP	11/14/23	64	
Paul	35	Gay/ Queer	Latino	Daily PrEP	11/15/23	56	
Juan	24	Gay	Latino	Daily PrEP	11/15/23	54	
Chris	48	Gay	White	HIV+ undetectable	11/15/23	60	
Adam	32	Gay	White	HIV+ unknown if undetectable	11/21/23	55	Reported current chemsex/meth use
Ian	67	Gay	White	HIV+ undetectable	11/28/23	87	
Ryan	39	Gay	White	HIV+ undetectable	11/28/23	59	Reported current chemsex/meth use

Table 2. Demographic Characteristics and Recruitment Sources of Sample

Demographic Factor	N (%)
Age	M=35.46; SD=10.48 Min=23; Max =67
Sexual Orientation	
Gay	18 (69.2%)
Bisexual	6 (23.1%)
Queer/Pansexual	2 (7.7%)
HIV Status	
HIV-	20 (76.9%)
Not on PrEP	4 (20%)
Daily PrEP	11 (55%)
On-Demand PrEP (2-1-1)	3 (15%)
Long-acting PrEP	1 (10%)
HIV+	5 (19.2%)
Undetectable	4 (80%)
Inconsistent med use	1 (20%)
Unknown HIV Status	1 (3.8%)
Race	
White (non-Hispanic)	13 (50.0%)
White (Hispanic)	1 (3.8%)
Black/African American	3 (11.5%)
Hispanic/Latino alone	7 (26.9%)
Asian	1 (3.8%)
Multiracial	1 (3.8%)
Relationship Status	
Single	19 (73.1%)
Non-monogamous Relationship	7 (26.9%)
US Region	
Northeast	2 (7.7%)
Mid-Atlantic	2 (7.7%)
Southeast	4 (15.4%)
Midwest	4 (15.4%)
Southwest	5 (19.2%)
West	9 (34.6%)
Religious affiliation	
Christian	10 (38.5%)
Buddhist	1 (3.8%)
Atheist/Agnostic/None	14 (53.8%)
No response	1 (3.8%)
Recruitment Source	
Sniffies	17 (65.4%)
Grindr	4 (15.4%)
Hornet	1 (3.8%)

Prolific	4 (15.4%)

Table 3. Group Differences Between Participants that Did and Did Not Report Alcohol Effects on Sexual Risk Behavior

	Participant Groups	
	Alcohol Affects Sexual Risk Behavior (N=11)	Alcohol Does Not Affect Sexual Risk Behavior (N=15)
Participants	Nate, Jack, Keith, Will, Jordan, Jerome, Diego, James, Antonio, Paul, Juan	Carlos, Brian, Daniel, Josh, Todd, Eric, Thomas, Alvaro, David, Charles, Fred, Chris, Adam, Ian, Ryan
Concerns about STIs	"*I have extreme anxiety over any STI. I was talking to somebody who had had syphilis and he said while it was able to be cured, the needle in his ass was very painful."* (Jordan, 30, gay, white, 2-1-1 PrEP user) *"I personally hate, hate, hate, hate, hate it when I get [an STI]. You have to go get treatment, and treatment can hurt depending on which one it is."* (Nate, 24, bisexual, Latino, daily PrEP user) *"The very first time that I got an STI was a few years ago and I was dating somebody. That person didn't take this news well, and me getting an STI actually ended the relationship. So now I have that on my mind."* (Diego, 36, gay, Latino, daily PrEP user)	*"[Regarding testing positive for an STI] You know, if it happens it happens and there's treatment. [...] With the partners I have, it's very much this understanding that we know what we're getting into and if it should happen then we just tell each other and move on."* (Chris, 48, gay, white, HIV+ and undetectable) *"[STIs] worry me, but obviously not enough for me to use a condom. [...] I've never had another STI [other than HIV]"* (Ian, 67, gay, white, HIV+ and undetectable) *Not once has any [worry about STIs] even crossed my mind. I never had any STIs and I'm the type of person that... I have to go through something; I have to learn the hard way. [...] I've really never had doctors or anybody in my adult life just talk to me about it [STIs]."* (Adam, 32, gay, white, HIV+, unknown if undetectable)
Effects of alcohol on STI concerns and condom use	*"[When I'm drunk] the part of me that's more concerned with my safety and not catching STIs just goes out the window and I just do what feels good at the moment."* (Juan, 24, Latino, gay, daily PrEP user) *"Sober I know, like intellectually, I need to worry about [STIs]. I need to make sure I don't catch this thing that could possibly kill me, or I could give it to somebody else. But when I'm drinking, that just all goes out the window. It just doesn't even cross my mind. […] Like performing well and enjoying [sex] is more important than anything else."* (Keith, 38, bisexual, white, no PrEP use)	*"If someone wants to use a condom, they can still use a condom. [...] I know what I like and the alcohol's not going to change what I like. I'm not being convinced by alcohol to do something that I wouldn't normally do."* (Chris, 48, gay, white, HIV+ and undetectable) "*In terms of condom use, [alcohol] has no effect. I don't really bother with condoms anyway. I don't really find that I care enough to use one, so alcohol doesn't impact that one way or another."* (Josh, 28, gay, white, daily PrEP user)

Harnessing the Power of Mixed-Methods Research: Informing Quantitative Analyses with Qualitative Findings

Interstitial

Using the Inhibition Conflict Model (ICM; Steele & Southwick, 1985) as a guiding framework, the previous paper sought to explore MSM's perceptions of alcohol intoxication on their sexual risk behavior and identify potential inhibition factors that may serve as moderating factors. Results were informative for future quantitative research, suggesting that key moderators for alcohol's effects on sexual risk behavior may include partner familiarity (i.e., having sex with new vs. established partners) and concerns about HIV and other STIs. Results of this study also suggest that in addition to decisions about condom use during a sexual encounter, research should assess for decisions about other behaviors during the encounter (e.g., anal sex vs. oral sex) and decisions made before the encounter (e.g., whether to hook up with someone).

This study was part of a larger mixed methods study that also included collection of a large cross-sectional survey. In mixed-methods research, the qualitative and quantitative components are ideally completed sequentially, so that the findings of one study can inform the development and research questions of the other study. In the case of this study, the qualitative and quantitative data collection happened simultaneously due to logistical constraints, and therefore the findings of each study could not inform the development of the other. However, analyzing the qualitative and quantitative data in parallel proved to be informative, and the results of the qualitative data did influence the direction of the exploratory aims of the quantitative study.

First, the results of the qualitative results suggested that partner familiarity was an important factor to consider in analyzing the quantitative data. These results suggested that some

participants are more likely to have condomless sex with regular or casual partners because of a greater sense of trust and open communication. However, the point at which this trust and open communication are established varied greatly between participants, with some participants being comfortable after a few sexual encounters and others requiring an exclusive sexual relationship. The survey asked participants to identify whether their sexual partner was a romantic partner, casual partner, or hookup partner. However, other factors relevant to partner familiarity, such as level of trust with a partner, how long they had known the partner, how many times they previously had sex with that partner, and their perceptions of that partner's risk level, were not measured. It was therefore clear that the heterogeneity in participants' distinction between new and established partners could not be captured with this survey question, and if differences emerged between sexual engagements with new and established partners, it would be difficult to interpret these findings. It was therefore decided to exclude encounters with romantic partners from analysis (as has been done in most previous research), and to exclude analyses of group differences between hookup and casual partners.

Second, the qualitative data indicated that a wide variety of sexual risk behaviors could be affected by alcohol (condom use, anal sex, communicating with a partner, deciding whether to have sex, PrEP use) in a variety of settings (during the sexual encounter, before the sexual encounter, when searching for a sexual partner, when deciding whether to search for a sexual partner). In the survey, only condom use and anal sex were assessed during the sexual encounter, and no behaviors were assessed in the lead-up to the sexual encounter. Unfortunately, nothing could be done about this at the analysis stage, but it nevertheless served as a helpful talking point in the limitations section of the discussion. It also served as an important discussion point for the

future research section, given that a majority of event-level research has ignored these other relevant behaviors, and these behaviors are becoming more relevant in the era of PrEP.

Finally, the importance of STI concerns as an inhibition factor was clear across the interviews, and appeared to serve as a differentiator between participants who did and did not report effects of alcohol. This influenced the decisions about which inhibition factors to include in the final quantitative models. Inhibition factors that were not relevant to STI risk, such as sexual inhibition due to performance anxiety and relationship importance, were ultimately dropped from the analyses.

The Effects of Alcohol and Chemsex on Sexual Risk Behavior in Men Who Have Sex with Men: Moderating Effects of PrEP Use and Inhibition Conflict

Paper 2

Abstract

HIV continues to be a serious public health concern among men who have sex with men (MSM). While experimental research has shown consistent evidence for a causal effect of alcohol on sexual risk behavior, event-level research has produced mixed results. Chemsex, or sex under the influence of drugs like methamphetamine, MDMA, and GHB, has also shown inconsistent effects on condomless sex in the event level research. Guided by the Inhibition Conflict Model of Alcohol Myopia (ICM), and the Dual Control Model of Sexual Response (DCM), the present study explores the event-level relationship between alcohol/chemsex use and sexual risk behavior in a cross-sectional sample of MSM (N=464). Event level data from N=1049 sexual encounters were assessed using a series of generalized hierarchical linear regressions. Alcohol and chemsex use showed inconsistent associations with sexual risk behaviors in the full sample but were consistently positively associated with sexual risk behavior for participants who did not use PrEP or were living with HIV and did not currently have an undetectable viral load. Further exploratory analyses indicated that for PrEP non-users, presence of inhibition conflict (i.e., simultaneously high sexual sensation seeking and concerns about HIV/STIs) moderated the relationship between alcohol use and sexual risk behaviors, with those indicating greater inhibition conflict showing stronger effects. Results are discussed in the context of the limited research on the ICM and future directions for MSM-focused sexual health research integrating the ICM and DCM.

Alcohol Intoxication and Sexual Risk Behavior in MSM

Experimental research has consistently found alcohol intoxication to increase likelihood of condomless sex (George, 2019; Maisto & Simons, 2016). However, reviews of event-level research indicate mixed findings for the real-world effects of alcohol on sexual behavior (Maisto & Simons, 2016; Vosburgh et al., 2012), and event-level studies conducted since these reviews have continued to produce mixed findings (Gleason et al., 2023; Wray et al., 2020). There is stronger event-level evidence for the effects of high-level alcohol intoxication (i.e., binge drinking) on condomless sex (Kahler et al., 2015; Vosburgh et al., 2012), and significant moderating effects have been found for variables like age (Mustanski, 2008; Newcomb, 2013) and relationship to partner (i.e., primary partner vs. casual partner; Vanable et al., 2004). However, few studies have investigated such moderating factors; and, in the case of age, those studies found conflicting effects. Mustanski (2008) found that alcohol had a greater effect on sexual risk behaviors in older participants, while Newcomb (2013) found alcohol had a greater effect in younger participants. Thus, research up to this point has not provided a clear understanding of when and for whom alcohol has an effect on sexual risk behavior.

Drug Use and Sexual Risk Behavior in MSM

A review of the literature by Vosburgh et al. (2012) found that, similar to alcohol use, there is mixed evidence for the association between drug use and condomless anal sex (CAS) among MSM. The one exception is methamphetamine use, which is consistently associated with CAS. This is consistent with research on "chemsex," or use of certain drugs like methamphetamine, GHB, and MDMA in sexual contexts for the purpose of enhancing the sexual experience (Giorgetti et al., 2017). MSM who report engaging in chemsex consistently report increased sexual risk behavior, and chemsex has been identified as a major contributing factor to

the continued spread of HIV in the MSM community (Maxwell et al., 2019). However, as is true with alcohol research, there is limited research on when and for whom chemsex is associated with sexual risk, and research is complicated by the fact that chemsex, especially involving polysubstance use, has been inconsistently defined and assessed in the research (Vosburgh et al., 2012). In addition, because experimental research on this topic is not feasible, it is unclear whether drug intoxication has a causal effect on sexual behaviors or whether it merely co-occurs with sexual risk behavior.

Sexual Risk Behavior and Substance Use in the Context of PrEP and U=U

In the past decade, the landscape of HIV prevention has changed due to the introduction of pre-exposure prophylaxis (PrEP) and the public health messaging that "undetectable equals untransmittable (U=U), meaning that individuals with undetectable HIV viral loads are not able to transmit HIV to others. In recent years, as many as one third of MSM in the United States who qualify for PrEP use currently have a prescription for PrEP, and about two-thirds of individuals living with HIV maintain an undetectable viral load (CDC, 2024). Therefore, while condom use has been the primary focus of prevention efforts for decades, prevention efforts in recent years have shifted toward PrEP and U=U. Because these methods do not involve in-the-moment decisions during sexual encounters, they may be less affected by acute substance use.

Limited research on alcohol, chemsex, and sexual risk behavior has addressed PrEP and U=U factors. Studies that have considered these factors have used them as screener variables (i.e., excluding participants who use PrEP; Wray et al., 2020) or have brought up these factors in the discussion of their results (i.e., discussing that a majority of HIV-positive indivdiuals in a research study are undetectable; Kahler et al., 2015). However, condomless sex among MSM, even if they are on PrEP or have an undetectable viral load, remains a relevant risk behavior for

STIs other than HIV. Therefore, understanding the effects of alcohol on sexual risk behavior in this community remains a relevant research focus. In fact, it is especially relevant given that MSM using PrEP may engage in "risk compensation" (i.e., engaging in more frequent condomless sex), especially if they are heavy drinkers (Luehring-Jones et al., 2019; Newcomb et al., 2018).

Inhibition Conflict and Alcohol/Drug Effects on Sexual Risk

The Inhibition Conflict Model of Alcohol Myopia (ICM) can provide a framework for understanding when and for whom alcohol can affect sexual risk behavior among MSM. This model states that because of alcohol' disinhibitory effects, it will only change the behavior of individuals who experience inhibition conflict (i.e., simultaneously elevated sexual instigation and inhibition). Though this model was originally developed to explain alcohol's effects, it has been applied to drug intoxication as well (Noel et al., 2013). To date, no studies have investigated the validity of the ICM in samples of MSM. A few studies have tested the ICM in heterosexual samples, and they have generally supported the validity of the ICM. Four studies have found that alcohol has a stronger effect on condom use when individuals are conflicted or ambivalent about condom use (Dermen & Cooper, 2000; Jaffe et al., 2023; Kiene et al., 2016; Murphy et al., 1998). However, another study found no evidence for inhibition conflict effects (Corbin & Fromme, 2002); and Cooper & Orcutt (1997) reported mixed results, finding inhibition conflict effects among men but not women. Given the limited research on this model, there is much work to be done before the ICM can be considered a well-validated model of alcohol's effects on sexual behavior.

Another factor that complicates the evidentiary support of the ICM is that these studies have inconsistently measured inhibition conflict. For instance, some studies assessed inhibition

conflict with a single item or a series of items that intended to capture ambivalence about whether to have sex or use a condom (i.e., "I was unsure about whether to use a condom;" Cooper & Orcutt, 1997; Dermen & Cooper, 2000; Jaffe et al., 2023). Other studies operationalize inhibition conflict with a three-way interaction (Kiene et al., 2016), a 2x2 experimental design (Murphy et al., 1998), or a dummy variable indicating high scores on measures of both benefits and risks of condomless sex (Corbin & Fromme, 2002). Instigation factors measured by these studies include partner attractiveness, preference for condom nonuse due to increased sensitivity, and perceived benefits of condomless sex. Inhibition factors included perceived negative outcomes of condom nonuse, condom use self-efficacy, positive attitude toward using condoms, intentions to use condoms, and a partner's number of previous sexual partners. The result of this inconsistency is that research on the ICM to date has not clearly identified how to best measure inhibition conflict, or which instigation and inhibition factors should be considered part of the model.

In addition, these studies measured inhibition conflict at the personality-level (Corbin & Fromme, 2002), event-level (Cooper & Orcutt, 1997; Dermen & Cooper, 2000; Jaffe et al., 2023; Murphy et al., 1998), or a combination of both (Kiene et al., 2016). While the ICM theoretically incorporates the effects of both personality- and situation-level factors, there has not been in-depth discussion about how to properly measure or conceptualize these different levels of instigation and inhibition factors or how these levels might interact. As a result, it is unclear how the ICM may operate differently at or across the personality and event levels, or even how to best test the model at these different levels.

Inhibition Conflict and The Dual Control Model of Sexual Response

The ICM's conceptualization of instigation and inhibition factors can be construed as parallel to the sexual excitation (i.e., instigation) and inhibition factors proposed by the Dual Control Model of Sexual Response (DCM; Bancroft et al., 2009). The DCM proposes that sexual arousal and sexual behavior are determined by sexual excitation (a system that increases sexual arousal and motivation) and sexual inhibition (a system that diminishes sexual arousal and motivation). Sexual excitation and inhibition factors are important personality- and situation-level factors that affect the sexual excitation and inhibition systems and can be key detainments of sexual risk behavior. For instance, sexual risk behavior among MSM is consistently associated with increased personality-level sexual excitation and diminished sexual inhibition related to potential negative consequences of sexual behavior (Janssen & Bancroft, 2023).

While these models bear similarity, no research to date as attempted to integrate these models. Such integration would help to formalize assessment of sexual instigation/excitation and inhibition factors in the ICM and foster consistency between studies. It would also allow research on the ICM to be informed by the decades of research on the relationship between DCM factors and sexual risk. Perhaps most importantly, integrating this research would allow research on the ICM to expand beyond factors specific to condom use to personality factors that are relevant to all aspects of sexual behavior. For instance, given the relevance of personality-level sexual excitation and inhibition factors to sexual risk behavior, it is likely that alcohol would differentially affect individuals who are high in both sexual excitation (i.e., high sex drive) and high in sexual inhibition (i.e., concerned about negative consequences like STIs). Such findings would help to more precisely identify when and for whom alcohol affects sexual risk behavior.

The Present Study

Given the mixed results of event-level research, this study seeks to identify factors that may moderate the relationship between alcohol intoxication/chemsex and sexual risk behavior among MSM. Guided by the ICM and DCM, this study seeks to identify personality- and event-level sexual excitation and inhibition factors that moderate the relationship between alcohol/chemsex and sexual behavior. This study utilizes data collected from a cross-sectional online survey that assessed retrospectively reported sexual behaviors and substance use among a large sample of MSM. The first aim of this study is to confirm the findings of previous event-level research by examining the relationship between event-level alcohol intoxication, chemsex, and sexual risk behavior. We will also attempt to replicate findings of previous studies indicating significant moderating effects of binge drinking and age. The second aim of this study is exploratory; given the relevance of PrEP and U=U to sexual risk behavior, we will explore the moderating effects of these factors on the relationship between alcohol/chemsex and sexual risk behavior. In addition, guided by the ICM and DCM, we will explore personality- and event-level inhibition conflict factors that may serve as moderating factors for alcohol's effects.

Methods

Recruitment

Participants for the study were recruited using online advertisements on various LGBTQ+ dating/hookup applications (Sniffies, Grindr, Hornet) and crowdsourcing websites (Prolific, Connect). Study advertisements invited queer men who drink alcohol to participate in an online survey to earn a $10 gift card. A total of N=4217 individuals clicked the advertisement and completed the screening questionnaire. Participants were eligible to complete the survey if they identified as a cisgender man, lived in the United States, were age 18 or older, and reported engaging in the following behaviors in the past 3 months: a) at least one instance of heavy

episodic drinking (5+ drinks on one occasion); b) CAS with at least one male partner; and c) sex with more than one sexual partner.

Participants and Procedure

Eligible participants (N=2012) were invited to complete a 20-minute survey about sexual activities and alcohol use. A total of N=1282 individuals completed at least 75% of the survey. Participants were excluded from analysis if they completed the screener or survey more than once (as indicated by IP address; N=211), took the survey on days when the survey was not advertised (i.e., an indication of survey fraud; N=86), failed validity check questions (N=218), their IP addressed was flagged for recent fraudulent activity by ipqualityscore.com (N=230), or failed questions used to identify acquiescence bias (N=25). Remaining participants (N=512) reported a total of N=1467 sexual encounters. Encounters were excluded from analysis if participants reported that they took place greater than 3 months ago (N=23), reported that the encounter involved more than one partner (N=266) or did not respond to this question on the survey (N=1), reported they engaged in vaginal sex with a cisgender man (N=9), if they responded "other" when describing their relationship with the partner (N=3), or reported the sexual encounter was with a romantic partner (N=117). This resulted in a total sample of N=464 participants included in analysis. Descriptive statistics of demographic factors for this sample are displayed in Table 1.

Participants that passed the study screener and consented to participate in the quantitative survey were directed to an online Qualtrics survey. The survey took approximately 20-25 minutes to complete. Participants were given 24 hours to complete the survey and were invited to take breaks and return to the survey if they chose. At the end of the survey, participants were

thanked for their participation and asked to provide their email address to receive a $10 Amazon gift card.

Measures

Demographics

Participants completed a series of demographic questions, including age, gender identity, sex assigned at birth, race/ethnicity, sexual orientation, income, zip code, rurality (i.e., located in an urban, suburban, or rural area), level of education, employment status, relationship status, religiosity, political affiliation (from "very liberal" to "very conservative"), and weight. Full descriptive statistics of demographic variables are located in Table 1.

HIV Status and Treatment/Prevention

Participants were asked to indicate their current HIV status (HIV-positive, HIV-negative, or unknown). Those who were HIV-positive were asked whether they currently take anti-retroviral medications to treat HIV, and if so, whether their current viral load is undetectable. If participants indicated they were HIV negative or do not currently know their HIV status, they were asked whether they had ever heard of or used PrEP. Those who had heard of and used PrEP were asked whether they currently use PrEP, and if so, which modalities they use (i.e., daily PrEP, long-acting (injectable) PrEP, or on-demand (2-1-1) PrEP). Participants currently using daily PrEP were asked how many doses of PrEP they had taken in the past 30 days (less than 16, 16-29, or 30).

To account for participants' risk of HIV transmission, a composite "HIV protection" variable was calculated for each participant. This variable was binary, with "0" indicating that the participant either: a) was HIV-positive and reported an undetectable viral load, or b) was HIV-negative or did not know their HIV status, was currently using daily or long-acting PrEP,

and if they were using daily PrEP, reported taking at least 17 doses of PrEP in the last 30 days. A code of "1" indicated the participant was not currently protected from HIV transmission, and a code of "0" indicated they were currently protected.

Alcohol Use Frequency

Alcohol use frequency was assessed using the NIAAA Recommended Alcohol Questions (NIAAA, 2020) Participants were asked "in the past 12 months, how often did you usually have any kind of drink containing alcohol?" They responded on an 8-point scale from "every day" to 1 or 2 times in the past year."

Personality-Level Sexual Excitation and Inhibition Factors

Sexual Sensation Seeking Scale.

The Sexual Sensation Seeking Scale (SSSS; Kalichman et al., 1994) is a 10-item scale assessing preference for exciting and novel sexual activities. Participants respond to items on a 4-point Likert scale from "not at all like me" to "very much like me." Example items include "I like wild 'uninhibited' sexual encounters" and "I am interested in trying out new sexual experiences." Internal consistency for this sample was good ($\alpha = .81$).

Sexual Excitation/Inhibition Scales- Short Form.

The Sexual Excitation/Inhibition Scales – Short Form (SE/IS-SF; Carpenter et al., 2019) is a 14-item shortened version of the original 45-item scale (Janssen et al., 2002) that measures personality-level sexual excitation and inhibition. Sexual excitation is a single factor (SES), with individuals scoring high on this factor reporting greater or more responsive sexual arousal from a greater variety of sources. Items include "when a sexually attractive stranger accidentally touches me, I easily become aroused" and "when I start fantasizing about sex, I quickly become sexually aroused." Sexual inhibition has two factors, with higher scores on the first factor (SIS1)

indicating greater performance anxiety and easier loss of sexual arousal (i.e., "I cannot get aroused unless I focus exclusively on sexual stimulation"). Higher scores on the second factor (SIS2) indicate greater loss of arousal in response to threat of negative consequences, such as STIs or being seen by other people ("If I realize there is a risk of catching a sexually transmitted disease, I am unlikely to stay aroused"). For the purposes of this study, only SES and SIS2 were included in analysis. Participants respond to items on a 4-point Likert scale from "strongly disagree" to "strongly agree." Internal consistency for this sample was good for SES ($\alpha = .77$) and adequate for SIS2 ($\alpha = .62$).

Reactions to Homosexuality Scale.

The Reactions to Homosexuality Scale (RHS; Smolenski et al., 2010) is a measure of internalized homonegativity, or internalized negative attitudes about one's own sexual minority identity. The scale contains 7 items assessing three factors: Personal comfort with gay identity (e.g., "Even if I could change my sexual orientation, I wouldn't"), social comfort with gay men (e.g., "I feel comfortable in gay bars"), and public identification as gay (e.g., "I feel comfortable being seen in public with an obviously gay person"). Participants respond on a 7-point Likert scale from "strongly disagree" to "strongly agree." For this study, items with specific reference to gay identity were revised to include bisexual and queer identities; for instance, "I feel comfortable being a homosexual man" was revised to "I feel comfortable being a gay/bi/queer man"). Internal consistency for this sample was good for the entire scale ($\alpha = .78$). Cronbach's Alpha was not calculated for the individual subscale due to the subscales consisting of only 2-3 items.

Concern about STI/HIV Risk.

Participants were asked two questions to assess their concern about their current risk for HIV and other STIs. HIV-negative participants were asked "how concerned are you that you could become HIV-positive if you had anal sex with someone and did not use a condom?" and HIV-positive participants were asked "How concerned are you that you could transmit HIV to someone if you had anal sex with them and did not use a condom?" All participants were asked "How concerned are you that you could contract a STI other than HIV (such as chlamydia, gonorrhea, syphilis, HPV, etc.) if you had anal sex with someone and did not use a condom?" Participants responded to these two questions on a 4-point Likert scale ranging from "not at all concerned" to "very concerned."

Personality-Level Inhibition Conflict Variables.

Eight composite binary variables were created to identify participants with elevated personality-level inhibition conflict. For these variables, inhibition conflict was defined has scoring above-average on a measure of sexual excitation (i.e., SSSS, SES) and a measure of sexual inhibition (HIV concern, STI concern, SIS2, RHS). Thus, all possible combinations of excitation and inhibition variables resulted in 8 compositive variables (i.e., SSSS + HIV concern, SSSS + STI concern, SSSS+ SIS2, SSSS + RHS, SES + HIV concern, SES + STI concern, SES + SIS2, SES + RHS). For each variable, participants who scored above the sample mean for both the excitation and inhibition variable were coded as "1" and all others were coded as "0." A code of "1" indicated the participant experienced elevated inhibition conflict in the specified personality-level domains.

Event-Level Variables

Recent Sexual Encounters.

Participants were asked questions about their most recent sexual encounter with their three most recent sexual partners. To assess this, participants were first asked how many different sexual partners they had in the past three months, and the names or pseudonyms of their three most recent partners (or fewer if they reported fewer than three sexual partners in the past three months). Participants were then asked specific questions about each of these partners, including the partner's gender, HIV status (positive, negative, or unknown), current viral load (if HIV-positive) or current PrEP use (if HIV-negative or unknown), and their relationship to the partner (i.e., romantic, casual, or hookup partner). Participants were then asked questions about their most recent sexual encounter with each of these recent partners including how recently the sexual encounter happened (i.e., within the last few days, last few weeks, in the past 3 months, or greater than 3 months ago), which sexual behaviors they engaged in with the partner (i.e., mutual masturbation, oral sex, vaginal sex, and receptive/insertive anal sex), whether a condom was used for each vaginal/anal sex behavior (i.e., a condom was used all of the time, part of the time, none of the time, can't remember), and whether on-demand (2-1-1) PrEP or PEP was used by the participant for the sexual encounter.

Sexual Risk Behavior Outcome Variables.

Three binary outcome variables were calculated for each sexual encounter reported by participants. The first variable, "penetrative sex" (PS) indicated whether the participant engaged in anal or vaginal sex with the partner (vs. oral sex or mutual masturbation). The second variable, "condomless penetrative sex" (CPS) indicated whether the participant engaged in anal or vaginal sex without a condom (vs. anal or vaginal sex with a condom and any other sexual behavior). If the participant reported they used a condom for only part of the time or they could not remember if a condom was used, the event was considered a condomless sexual encounter. The third

variable, “condomless penetrative sex with elevated HIV risk” (HIVCPS) indicated that the participant had penetrative sex without a condom and was at elevated risk for HIV. Elevated HIV risk was defined as: 1) the participant was coded as “0” for the HIV protection variable (i.e., they were not on PrEP or did not have an undetectable viral load); 2) The participant had sex with a serodiscordant or unknown status partner who was not using PrEP or did not have an undetectable viral load; and 3) the participant did not report using 2-1-1 PrEP or PEP with the sexual encounter.

Situation-level Alcohol and Substance Use.

For each sexual encounter, participants indicated whether they used alcohol, cannabis, poppers, methamphetamine, ketamine, cocaine, MDMA, hallucinogens, prescription medications, or other drugs during or just before the sexual encounter. If they indicated they had consumed alcohol, they were then asked how many standard drinks they consumed in the 12 hours prior to the sexual encounter (participants were provided with a chart displaying the size of one standard drink for various alcoholic beverages), the time they started drinking, the time of the sexual encounter, and their subjective level of intoxication on a scale from 1 (not at all drunk) to 10 (extremely drunk).

From this data, three alcohol use variables and one chemsex variable were calculated. Alcohol use variables included subjective intoxication (single-item response from 1-10), number of drinks (single item numeric response) and approximate blood alcohol concentration (BAC) at time of the sexual encounter. Approximate BAC was calculated using the Widmark formula, provided the participant’s number of standard drinks, hours of drinking, sex, and weight (Searle, 2015). Participants who reported drinking over a period greater than 12 hours were excluded from the BAC calculation. Engagement in chemsex at each encounter was defined as using

methamphetamine, ketamine, cocaine, MDMA, or GHB (i.e., a binary variable). GHB use was not directly assessed in the survey, but several participants reported GHB use by selecting "other drug" and providing a written description. Participants who reported no alcohol use or no drug use were coded as "0" for alcohol and chemsex variables respectively.

Situation-Level Sexual Excitation and Inhibition Factors.

For each sexual encounter, participants responded to 6 items assessing situational excitation and inhibition factors for condomless sex on a 5-point Likert scale from "strongly disagree" to "strongly agree." Four items assessed sexual excitation: "I was sexually attracted to this person," "I really wanted to experience the sensation of anal sex without a condom," "I really wanted them to ejaculate/cum inside me," and "I really wanted to ejaculate/cum inside them." For the last two items, a composite score was calculated reflecting the participant's highest score between the two items (i.e., to account for bottoming or topping in a sexual interaction). Two items assessed sexual inhibition: "I was worried that one of us would get an STI/HIV from anal sex," and "I wanted to use a condom if we had anal sex."

Six binary inhibition conflict variables were coded from these items to represent simultaneous inhibition and excitation for condomless sex (STI concern + attracted to partner, STI concern + desire condomless sensation, STI concern + desire condomless ejaculation, desire condom + attracted to partner, desire condom + condomless sensation, desire condom + condomless ejaculation). These items were coded as "1" if the participant responded with either "agree" or "strongly agree" to both the inhibition and excitation variable, and "0" if they did not. A code of "1" indicated inhibition conflict in at the event-level.

Attention Check Questions

Participants were asked two questions to assess their attention to the survey: "If you are reading this question please select less than monthly" and "How often is the letter 'w' the first letter of the alphabet?" with the correct response being "never." Responding incorrectly to either of these questions resulted in the participant being excluded from analysis.

Acquiescence Bias Questions

Participants were asked five questions to assess for acquiescence bias, or the tendency for survey participants to respond positively (i.e., "agree," "yes," etc.) to questions, especially if they are responding fraudulently or are responding without thoroughly reading a question (Kuru & Pasek, 2016). The purpose of these questions was to screen for survey fraud by identifying participants who reported impossible or highly improbable behaviors and experiences. First, participants were asked if they have been diagnosed with botulism or rubella in the past year (yes/no). Because both diseases are extremely rare in the United States, an affirmative response indicated likely fraud. Participants were also asked to indicate if they had used any brands of condoms, personal lubricant, or liquor from a list of supposed brand names. All brand names were fake (i.e., "SafeGrip," "JunkJam," "Vira") and therefore responses indicating they had used any brands of these items indicated likely fraud. Participants were excluded from analysis if they responded affirmatively to two or more of the five acquiescence bias questions.

Statistical Analyses

A series of generalized hierarchical linear models were conducted using R (V. 4.4.0) to assess event-level associations between subjective alcohol intoxication, number of drinks, estimated BAC, chemsex, and the three binary outcome variables. Moderation models included personality- and situation-level inhibition conflict variables as moderators for the relationship between alcohol intoxication and the outcome variables. All models excluded random effects, as

the inclusion of random effects for the alcohol and chemsex variables lead to an undefined model. In addition, all models assessing alcohol effects included age, alcohol use frequency, and situation-level chemsex as covariates. Models assessing effects of chemsex included age and situation-level alcohol use (binary variable indicating whether alcohol was used during the encounter). If models failed to converge with all covariates included, covariates were removed sequentially until the model converged. Other demographic variables were not included in these models given that they did not relate directly to the study hypotheses.

Results

A total of N=1049 sexual encounters were included in analysis, reported by N=464 participants. These included encounters with casual partners (N=428) and hookup partners (N=621). A majority of sexual encounters involved cisgender male partners (N=1016; 96.9%), though participants also reported sexual encounters with cisgender women (N=12), trans men (N=7), trans women (N=5), and nonbinary individuals (N=8). Sexual encounters happened within the last few days (N=168; 16.0%), within the last week (N=274; 26.1%), within the last month (N=391; 37.3%), and within the last 3 months (N=216; 20.6%).

Frequency of Alcohol Use and Chemsex with Sexual Encounters

A total of N=489 (46.6%) sexual encounters involved alcohol use. Responses for the alcohol use variables were missing for subjective intoxication (N=2; 0.4%) and estimated BAC (N=66; 13.5%), while no responses were missing for the number of drinks variable. Notably, several BAC estimates could not be calculated because participants reported alcohol use over a period greater than 12 hours (i.e., they did not report alcohol use duration based on the provided instructions). Because missingness for the estimated BAC variable was nonrandom, and because this variable is highly correlated with number of drinks (r=.87), both variables were utilized as

predictor variables. Alcohol use was reported in a similar number of encounters for HIV-negative (N=374; 46.3%) participants, HIV-positive (N=98; 47.6%) participants, and participants with unknown HIV status (N=17; 48.6%).

A total of N=183 (17.4%) sexual encounters involved chemsex. Of these encounters, a majority involved methamphetamine (N=158; 86.3%), while other drugs used included cocaine (N=18; 9.8%), ketamine (N=7; 3.8%), GHB (N=7; 3.8%), and MDMA (N=9; 4.9%). Chemsex use was more commonly reported in the sexual encounters of HIV-positive participants (N=75; 36.4%) and participants of unknown HIV status (N=16; 45.7%) compared to HIV-negative participants (N=92; 11.4%).

Confirmatory Analyses

To confirm previous research identifying alcohol intoxication and chemsex as predictors of condomless sex, a series of generalized hierarchical linear models were conducted. Results indicated that PS was positively associated with number of drinks, HIVCPS was positively associated with subjective intoxication, and CPS was positively associated with chemsex. No other associations were significant (see Table 2).

To confirm previous research indicating event-level binge drinking is associated with sexual risk behavior (i.e. alcohol has a greater effect at very high doses), a series of models were run including alcohol intoxication variables as quadratic terms. Results indicated that no quadratic factors significantly predicted any of the three sexual risk outcome variables, meaning that alcohol intoxication did not differentially predict the likelihood of sexual behavior at different levels of intoxication (see Table 2).

Finally, to confirm previous research indicating age significantly moderates the association between alcohol intoxication and condomless sex, a series of models were run

including age as a moderating variable. Results of these models (Table 2) indicate that age significantly moderated the effects of number of dinks on HIVCPS such that younger participants showed a positive association between number of drinks and likelihood of HIVCPS while older participants showed a negative association. No other moderations were statistically significant (see Table 2).

Alcohol & PrEP Use Interaction

To evaluate whether alcohol intoxication differentially effects sexual behavior for PrEP users and non-users, a series of models were conducted including interaction terms between alcohol intoxication variables and PrEP use. Only HIV-negative participants were included in these analyses. Because PrEP use was used to calculate the HIVCPS variable, and thus very few PrEP users engaged in HIVCPS, this outcome variable was excluded from analyses. Results are displayed in Table 3. PrEP use significantly moderated the effects of number of drinks (Figure 1), but not subjective intoxication or BAC, on PS, and moderated the effects of subjective intoxication (Figure 2), BAC (Figure 3), and number of drinks (Figure 4) on CPS. Simple effects for PrEP users and nonusers are displayed in Table 4. For individuals who were on PrEP, alcohol intoxication variables did not significantly predict PS or CPS. For individuals not using PrEP, all three alcohol intoxication variables were positively associated with increased likelihood of PS and CPS. In addition, subjective intoxication was positively associated with greater likelihood of HIVCPS, while BAC and number of drinks were not associated with likelihood of HIVCPS.

Bivariate associations between PrEP use and inhibition/excitation factors are displayed in Table 6. PrEP use was significantly associated with decreased concerns about becoming HIV positive and decreased internalized homonegativity scores. To determine whether differences in HIV concern and internalized homonegativity may explain the differential effect of alcohol use

on PrEP users and non-users, mediation analyses were run with HIV concern and RHS scores as covariates. Age and alcohol use frequency were removed as covariates from these models due to the models failing to converge with all covariates included. Results of these models indicated that all interaction effects between PrEP use and alcohol intoxication remained significant after controlling for HIV concern and internalized homonegativity.

Chemsex & HIV Protection Interaction

Due to the large percentage of HIV+ participants who reported chemsex, models assessing the interactive effects of chemsex and HIV protection included participants of all HIV statuses. Rather than including PrEP as a moderating variable, these models used the "HIV protection" variable as a moderator (i.e., coded as "0" if they were on PrEP or had an undatable viral load, "1" if they did not). Again, because HIV protection was used to calculate the HIVCPS outcome variable, interactive effects were not tested for HIVCPS as an outcome variable. Results of these analyses (Table 5) indicated that chemsex significantly interacted with HIV protection to predict CPS, but not PS (Figure 5). Simple effects for participants with and without HIV protection are displayed in Table 5. For individuals who had HIV protection, chemsex did not increase likelihood of PS or CPS, while individuals without HIV protection showed increased likelihood of engaging in CPS and HIVCPS when engaging in chemsex.

Bivariate associations between HIV protection and inhibition/excitation factors are displayed in Table 6. Similar to PrEP use, HIV protection was significantly associated with decreased concerns about becoming HIV positive or transmitting HIV and decreased internalized homonegativity scores. Thus, to determine whether differences in HIV concern and internalized homonegativity may explain the differential effect of chemsex on those with and without HIV protection, the mediation analysis was repeated with HIV concern and RHS scores as covariates.

Age was excluded as a covariate due to the model failing to converge with all covariates included. Results again indicated that interaction effects between HIV protection and chemsex remained significant after controlling for HIV concern and internalized homonegativity.

Personality-Level Inhibition Conflict and Alcohol intoxication

A series of mediation analyses were conducted using the eight personality-level inhibition conflict variables as moderation factors. Results are displayed in Table 7. Several interactive effects were significant for the "elevated SSSS + HIV concern" and "elevated SSSS + STI concern" inhibition conflict variables among PrEP non-users. These significant interactions indicated that HIV-negative participants not using PrEP with above-average SSSS scores and simultaneous above-average HIV and STI concerns showed greater effects of alcohol on PS and CPS. Participants with no conflict between SSSS and HIV/STI concern do not show effects of alcohol (See Figures 6 and 7). No other personality-level inhibition conflict variables showed consistent significant interactions with alcohol intoxication variables in these models.

Event-Level Inhibition Conflict and Alcohol Intoxication

A series of mediation analyses were conducted using the six event-level inhibition conflict variables as moderation factors. Results are displayed in Table 8. Several interactions were significant for the "STI concern + attracted to partner," "STI concern + desire condomless sensation," and "STI concern + desire condomless ejaculation" variables among PrEP users. These interactions indicated that for HIV-negative participants using PrEP, sexual situations in which they were concerned about STIs and simultaneously very attracted to their partner and/or interested in condomless sex showed greater effects of alcohol on PS and CPS. However, these effects were in the opposite direction from what was hypothesized: greater estimated BAC and number of drinks was associated with reduced likelihood of engaging in PS and CPS (See

Figures 8 and 9). No other event-level inhibition conflict variables showed consistent interactions with alcohol intoxication variables in these models.

Discussion

This study sought to investigate the effects of alcohol intoxication and chemsex on sexual risk behavior among MSM via a cross-sectional online survey assessing. Analyses first attempted to replicate the results of previous event-level research, and then sought to explore potential moderators of alcohol's effects. Moderation analyses were guided by the ICM, utilizing excitation and inhibition constructs drawn from the DCM.

Confirmatory Analyses

Results of the confirmatory analyses partially confirmed previous research indicating event-level associations between alcohol intoxication/chemsex and condomless sex. While some associations were significant, the majority were non-significant, providing further mixed evidence to the existing literature (Maisto & Simons, 2016; Vosburgh et al., 2012). In addition, confirmatory analyses examining quadratic effects of alcohol intoxication produced non-significant findings, failing to confirm the findings of previous studies (Kahler et al., 2015). While age significantly moderated the association between number of drinks and HIVCPS, all other moderations were non-significant, providing limited support for previous research indicating age as a moderating factor (Mustanski, 2008; Newcomb, 2013).

PrEP Use and HIV Protection as Moderating Factors

A key exploratory result from this study is the finding that PrEP use significantly moderated the effects of alcohol for HIV-negative participants, and HIV protection (i.e., PrEP use or undetectable viral load) significantly moderated the effects of chemsex for the full sample. These analyses suggested that for MSM who are not currently protected from HIV, alcohol

intoxication and chemsex increase the likelihood of sexual risk behavior, while those who are currently protected do not show effects of alcohol and chemsex. Though PrEP users and participants with HIV protection reported lower levels of concern about HIV and internalized homonegativity, moderations remained significant after controlling for these factors. We can therefore conclude that differences HIV concern and internalized homonegativity, as they were assessed in this study, do not fully explain the moderating effects of PrEP use and HIV protection.

These findings are in line with the inhibition conflict model: individuals with protection from HIV likely have fewer inhibitions about condomless sex, and therefore they would be unlikely to fall into the "high inhibition/high excitation" quadrant of the model. However, if this moderation can be fully explained by a lack of concern about STIs, then the methods of assessing HIV/STI concern in this study were not sufficient to capture this lack of inhibition. Beyond STI concern, participants with HIV protection may be self-selecting for differences in environmental or socioeconomic factors such as access to sexual healthcare resources or education that may explain this moderation. It therefore remains unclear what personality differences, if any, between participants with and without HIV protection may explain this moderation.

Inhibition Conflict Variables as Moderating Factors

In line with the inhibition conflict model, individuals who scored high on both measures of sexual sensation seeking and concern about HIV/STIs showed several positive associations between alcohol intoxication and sexual risk behavior. For these individuals, the inhibition conflict model suggests that alcohol disinhibits their sexual inhibitions around STI concerns in the moment, allowing motivations associated with sexual sensation seeking to influence their

decision making. Because research on the inhibition conflict model has utilized inconsistent methods of measuring inhibition conflict, it remains unclear which inhibition and excitation factors are most relevant to inhibition conflict. These results suggest that sexual sensation seeking and concerns about STIs may be key factors to consider in this model.

This study also indicated that at the event-level, alcohol intoxication is associated with decreased likelihood of engaging in sexual risk behavior among PrEP users under certain conditions of high inhibition conflict (i.e., elevated STI concerns paired with increased attraction and desire for condomless sex). This finding is inconsistent with the inhibition conflict model, and instead falls in line with previous research on Alcohol Myopia Theory suggesting that alcohol may decrease sexual risk behavior when strong inhibiting cues are present (MacDonald et al., 2000). For PrEP users in sexual encounters with high perceived STI risk, alcohol myopia may actually focus attention on these inhibiting cures and therefore decrease condomless sex. However, given that these items were newly developed and these analyses produced relatively small effect sizes, these results should be interpreted with caution.

Limitations

There are several limitations that must be considered with this study. First, this sample consisted of MSM who responded to online advertisements (mostly recruited from Sniffies), who reported heavy alcohol use and frequent sexual behavior. While this sample represents a population at high risk for HIV, it does not represent the wider population of MSM. The results therefore need to be interpreted in this context and understood to generalize to this specific high-risk population rather than MSM more broadly. Despite this more limited generalizability that this sample provides, the specificity adds rigor to understanding the effects of alcohol in a high-risk population, and therefore increases the internal validity of the findings.

Second, as is true with much online-based research, the integrity of the data must be considered. Survey fraud is rampant with online platforms, especially for paid research (Zhang et al., 2022), and the researchers encountered several instances of survey fraud. Ultimately, fewer than half of participants who completed the survey were included in the final analyses, many of whom were excluded due to indicators of fraud. While this might suggest selection bias in who was included in the final analyses, considerable efforts were made to ensure the validity of the sample, and ultimately the exclusion of the majority of survey respondents is a testament to the rigor of the validity checks rather than an indicator of selection bias.

Participants were asked to report details of sexual encounters that may have happened up to three months prior. While some encounters happened more recently, a majority happened more than a week prior to the survey. Because participants were tasked with recalling events, and specifically events that involved substance use, it is likely that their self-report may not be fully accurate and may be subject to recall bias. However, the survey was designed to prompt participants' memories with specific cues (i.e., prompting them to provide a name or description of the partner) that could aid in accurate recall of the event. There are advantages and limits of online survey designs, and the benefits of collecting a large online sample are weighed against the benefits of collecting more rigorous data (i.e., timeline follow-back, ecological momentary assessment) with a smaller sample. Ultimately, given the exploratory nature of this study, the benefits of a larger sample provided power to run multiple analyses that would not be possible to do with a smaller sample.

Finally, this study focused on condom use and anal sex behaviors during specific sexual encounters. Research suggests that alcohol can affect a wide variety of sexual behaviors both during and before a sexual encounter, including communication about condoms, decisions about

who to have sex with, and the decision to seek out a sexual partner in the first place (Gleason et al., 2023; Kahler et al., 2015; Mustanski, 2008; Wray et al., 2020). This means that alcohol may have affected additional behaviors beyond what was assessed in this study. Like this study, most quantitative research has focused on condom use decisions during "heat of the moment" sexual encounters. However, this focus is inherently limited, and behaviors in other settings should be considered in future event-level research.

Future Research

Given the significant moderating effects of PrEP use and HIV viral load in this study, future research should specifically explore alcohol and substance use effects among HIV-negative MSM who do not use PrEP and HIV-positive MSM who do not have an undetectable viral load. Research in these population should specifically seek out individuals who exhibit inhibition conflict related to high levels of concern about HIV and other STIs, as well as high levels of interest in novel and exciting sexual experiences (i.e., sexual sensation seeking). Because these individuals may constitute a particularly high-risk profile for alcohol effects of sexual risk behavior, they may also be a population that would benefit the most from interventions focused on substance use and HIV risk. Future research can confirm the validity of these findings and clarify in which ways interventions on sexual risk behavior can reach this population and effectively change behavior.

Future research should also seek to further integrate research on the ICM with existing research on the DCM. Well-researched sexual excitation and inhibition constructs from the DCM should be utilized in ICM research to help clarify what manifestations of inhibition conflict have the strongest moderating influence on alcohol's effects. Further integrating these models will

also allow this research to integrate more thoroughly with the DCM's basic behavioral and neuroscientific research on sexual response.

Finally, studies should follow up on these findings using more thorough event-level research designs like ecological momentary assessment (EMA). While cross-sectional survey designs are able to collect large, diverse samples, EMA provides more rigorous assessment of event-level behaviors and attitudes. Confirming the findings of this study with EMA would strengthen the finings while addressing the current study's weaknesses (i.e., survey fraud and recall bias). It would also allow for a more accurate assessment of time-based variables such as PrEP use (i.e., daily adherence) and alcohol use (i.e., start and stop times of drinking) that are challenging to assess cross-sectionally.

Conclusion

The current study sought to replicate existing event-level research on the relationship between alcohol intoxication/chemsex and sexual risk behavior using a cross-sectional survey design. Guided by the ICM and DCM, it is also the first study to explore the moderating effects of PrEP use, viral load, and inhibition conflict on the relationship between alcohol use and sexual risk in MSM. Findings indicated partial support of the ICM, with PrEP use, viral load, sexual sensation seeking, and HIV/STI concern emerging as potential moderating variables. Results also suggest that individuals without existing risk-mitigation strategies for HIV show the greatest vulnerability alcohol and chemsex effects on sexual risk behavior and would likely benefit the most from intervention. Future research should continue to integrate the ICM and DCM in the exploration of relevant inhibition conflict factors that contribute to sexual risk behavior.

Table 1

Demographic Characteristics and Recruitment Sources of Sample (N=464)

Demographic Factor	N (%)
Age	M=40.04; SD=11.86 Min=18; Max =72
Sexual Orientation	
Gay	354 (76.3%)
Bisexual	102 (22.0%)
Pansexual	5 (1.1%)
Straight	1 (0.2%)
Other	2 (0.4%)
HIV Status	
HIV-	360 (77.6%)
Not on PrEP	177 (49.2%)
Daily PrEP	169 (46.9%)
On-demand PrEP (2-1-1)	9 (2.5%)
Long-acting PrEP	5 (1.4%)
HIV+	89 (19.2%)
Undetectable Viral Load	75 (84.3%)
Unknown HIV Status	15 (3.8%)
Race	
White (non-Hispanic)	285 (61.4%)
Hispanic/Latino alone	78 (16.8%)
Black/African American	42 (9.1%)
Asian	20 (4.3%)
American Indian	2 (0.4%)
Pacific Islander	2 (0.4%)
Other	3 (0.6%)
Multiracial	31 (6.7%)
No answer	1 (0.2%)
Relationship Status	
Single	293 (63.1%)
Non-monogamous Relationship	141 (30.4%)
Monogamous Relationship	24 (5.2%)
Other	6 (1.3%)
Household Income	
Less than $10,000	41 (8.8%)
$10,000 – $29,999	70 (15.1%)
$30,000 – $49,999	82 (17.7%)
$50,000 – $79,999	100 (21.6%)
$80,000 – $99,999	44 (9.5%)
$100,000 – $174,999	71 (15.3%)
$175,000 or greater	50 (10.8%)

Don’t know	6 (1.3%)
Employment Status	
Employed full time	298 (64.2%)
Employed part time	46 (9.9%)
Student	25 (5.4%)
Homemaker	1 (0.2%)
Unemployed	52 (11.2%)
Disabled or unable to work	16 (3.4%)
Retired	18 (3.9%)
Other	8 (1.7%)
US Region	
Northeast	68 (14.7%)
Mid-Atlantic	16 (3.4%)
Southeast	80 (17.2%)
Midwest	75 (16.2%)
Southwest	77 (16.6%)
West	148 (31.9%)
Religious Affiliation	
Christian	162 (34.9%)
Jewish	11 (2.4%)
Muslim	1 (0.2%)
Hindu	2 (0.4%)
Buddhist	6 (1.3%)
Atheist/Agnostic/None	249 (53.7%)
Other	11 (2.4%)
No response	22 (4.7%)
Political Affiliation	
Very liberal	98 (21.1%)
Liberal	153 (33.0%)
Slightly liberal	52 (11.2%)
Moderate, middle of the road	95 (20.5%)
Slightly Conservative	28 (6.0%)
Conservative	21 (4.5%)
Very conservative	6 (1.3%)
Other	11 (2.4%)
Recruitment Source	
Sniffies	398 (85.8%)
Grindr	11 (2.4%)
Hornet	13 (2.8%)
Prolific	30 (6.5%)
Connect	12 (2.6%)

Table 2

Direct Effects of Alcohol and Chemsex

	Penetrative Sex			Condomless Penetrative Sex			Condomless Penetrative Sex + Elevated HIV Risk		
	β	SE	*P*	*β*	SE	*P*	*β*	SE	*P*
Step 1: Direct effects									
Subjective intoxication	.07	.04	.10	.04	.04	.24	**.25**	**.11**	**.03**
BAC	2.28	2.13	.28	2.06	1.96	.29	-1.28	5.66	.82
Number of Drinks	**.07**	**.03**	**.04**	.05	.03	.12	-.06	.09	.53
Chemsex	.31	.28	.27	**.52**	**.26**	**.049**	1.04	.81	.20
Step 2: Direct effects + Quadratic terms[1]									
Subjective intoxication (quadratic)	.01	.02	.48	.02	.02	.29	.08	.04	.08
BAC (quadratic)	.66	19.64	.97[1]	16.88	19.02	.37[1]	-39.38	49.41	.42[1]
Number of Drinks (quadratic)	.001	.006	.89[1]	.007	.006	.24[1]	.001	.012	.93
Step 3: Direct effects + Age as moderating factor									
SI*Age	-.002	.004	.45	.002	.004	.58	.01	.01	.18
BAC*Age	.13	.20	.51	.36	.19	.06	1.06	.60	.08
#Drinks*Age	.002	.003	.49	.005	.003	.09	**.02**	**.01**	**.02**

Note. All models including alcohol variables as predictors included each of the three alcohol variables separately with event-level chemsex, age, and alcohol use frequency as covariates. The models including event-level chemsex as a predictor variable were run with alcohol use (i.e., yes/no if alcohol was used with sexual encounter) and age as covariates. [1]Age was excluded as a covariate due to models failing to converge with all covariates included.

Table 3

Interaction Effects of Alcohol and PrEP Use

	Penetrative Sex			Condomless Penetrative Sex			Condomless Penetrative Sex + Elevated HIV Risk		
	β	SE	*P*	*β*	SE	*P*	*β*	SE	*P*
SI*PrEP	-.16	.09	.08	**-.20**	**.09**	**.02**	**-**	**-**	**-**
BAC*PrEP	-6.55	4.96	.19	**-14.10**	**4.67**	**<.01**	**-**	**-**	**-**
#Drinks*PrEP	**-.18**	**.08**	**.02**[1]	**-.29**	**.07**	**<.001**	**-**	**-**	**-**

[1]Model excluded age as a covariate due to models failing to converge with all covariates included

Table 4

Simple Effects of Alcohol for PrEP Users and Non-Users

	Penetrative Sex			Condomless Penetrative Sex			Condomless Penetrative Sex + Elevated HIV Risk		
	β	SE	*P*	*β*	SE	*P*	*β*	SE	*P*
PrEP users									
Subjective intoxication	.004	.06	.95	-.03	.06	.61	-	-	-
BAC	.54	3.55	.88	-3.99	3.24	.22	-	-	-
Number of Drinks	-.01	.05	.82	-.08	.05	.11	-	-	-
Non-PrEP users									
Subjective intoxication	**.18**	**.07**	**.02**	**.17**	**.07**	**.01**	**.33**	**.13**	**.01**
BAC	**6.86**	**3.44**	**.046**	**9.13**	**3.35**	**.01**	0.08	5.45	.99
Number of Drinks	**.19**	**.06**	**<.01**	**.21**	**.06**	**<.001**	.004	.09	.97

Table 5

Interactions and Simple Effects of Chemsex for Participants with and Without HIV Protection

	Penetrative Sex			Condomless Penetrative Sex			Condomless Penetrative Sex + Elevated HIV Risk		
	β	SE	*P*	*β*	SE	*P*	*β*	SE	*P*
Chemsex*HIV protection	.65	.56	.24	**1.25**	**.53**	**.02**	-	-	-
HIV Protection									
Chemsex	-.01	.40	.99	-.07	.35	.84	-	-	-
No HIV protection									
Chemsex	.66	.39	.09	**1.21**	**.40**	**<.01**	**2.13**	**.63**	**<.001**

Note. Participants were considered to have HIV protection if they were HIV-negative and used daily or long-acting PrEP or were HIV-positive and had an undetectable viral load. All models included alcohol use (i.e., yes/no if alcohol was used with sexual encounter) and age as covariates.

Table 6

Bivariate Associations Between PrEP use/HIV Protection Variables and Personality-Level Inhibition/Excitation Factors

	1	2	3	4	5	6	7
1. PrEP Use[1]							
2. HIV Protection[2]	-.95**						
3. HIV Concern	-.35**	.36**					
4. STI Concern	-.01	.03	.57**				
5. RHS	-.19**	.24**	.27**	.21**			
6. SIS2	-.03	.0003	.13*	.21**	.11*		
7. SES	.10*	.08	.02	-.04	-.09	-.23**	
8. SSSS	-.01	.004	.07	-.11*	-.13*	-.30**	.41**

Note. *p<.05; **p<.001. [1]N=843; Variable coded as 0=no PrEP use, 1=PrEP use. [2]Variable coded as 0= PrEP use or undatable viral load; 1= no PrEP use or detectable/unknown viral load.

Table 7

Exploratory Analyses of Personality-Level Moderating Inhibition Conflict Variables

		Penetrative Sex			Condomless Penetrative Sex			Condomless Penetrative Sex + Elevated HIV Risk		
		β	SE	*P*	*β*	SE	*P*	*β*	SE	*P*
PrEP users										
Moderator	Alcohol Variable									
Elevated	Main effect	-.15	.48	.76	-.21	.48	.66	-	-	-
SSSS +	*Subj. Intox.	.11	.18	.55	-.001	.17	.99	-	-	-
HIV	*BAC	.28	7.56	.97	-1.91	6.74	.78	-	-	-
Concern	*# Drinks	.001	.13	.95	-.07	.06	.12	-	-	-
Elevated	Main effect	-.21	.16	.20	-.31	.16	.05	-	-	-
SSSS +	*Subj. Intox.	.02	.07	.80	-.04	.07	.54	-	-	-
STI	*BAC	-1.73	4.10	.67	-6.52	4.22	.12	-	-	-
Concern	*# Drinks	.02	.05	.76	-.02	.05	.61	-	-	-
Elevated	Main effect	.02	.36	.96	.20	.36	.57	-	-	-
SSSS +	*Subj. Intox.	.27	.15	.06	**.30**	**.14**	**.03**	-	-	-
Elevated	*BAC	13.69	8.95	.13	**17.35**	**7.77**	**.03**	-	-	-
SIS2	*# Drinks	.14	.12	.22	.20	.11	.07	-	-	-
Elevated	Main effect	-.14	.41	.73	.03	.42	.95	-	-	-
SSSS +	*Subj. Intox.	.07	.16	.67	.06	.16	.69	-	-	-
Elevated	*BAC	1.96	7.48	.79	6.41	6.91	.35	-	-	-
IH	*# Drinks	-.01	.13	.94	.01	.12	.90	-	-	-
Elevated	Main effect	-.46	.45	.31	-.34	.46	.46	-	-	-
SES +	*Subj. Intox.	.01	.20	.96	-.05	.20	.81	-	-	-
HIV	*BAC	-12.9	12.70	.31	-16.8	12.93	.19[1]	-	-	-
Concern	*# Drinks	-.06	.17	.71	-.07	.17	.68	-	-	-
Elevated	Main effect	-.41	.32	.20	-.26	.32	.42	-	-	-
SES +	*Subj. Intox.	-.09	.14	.51	-.12	.13	.36[1]	-	-	-
STI	*BAC	-10.7	8.28	.20	-6.13	7.90	.44[1]	-	-	-
Concern	*# Drinks	-.04	.12	.75	-.05	.12	.70	-	-	-
Elevated	Main effect	.07	.35	.85	.07	.35	.84	-	-	-
SES +	*Subj. Intox.	.05	.13	.71	.07	.13	.61	-	-	-
Elevated	*BAC	-.75	8.52	.93	8.41	8.51	.32	-	-	-
SIS2	*# Drinks	.04	.13	.78	.18	.13	.15	-	-	-
Elevated	Main effect	.07	.35	.85	.07	.35	.84	-	-	-
SES +	*Subj. Intox.	.05	.13	.71	.07	.13	.61	-	-	-
Elevated	*BAC	-.75	8.52	.93	8.41	8.51	.32	-	-	-
IH	*# Drinks	.04	.13	.78	.18	.13	.15	-	-	-
Non-PrEP users										
Moderator	Alcohol Variable									
Elevated	Main effect	-.07	.42	.88	**-.20**	**.42**	**.63**	-.08	.96	.93
SSSS +	*Subj. Intox.	**.26**	**.10**	**<.01**	.23	.14	.09	-.04	.27	.88
HIV	*BAC	**32.48**	**12.74**	**.01**	**17.46**	**8.79**	**.047**	13.32	13.95	.34[1]
Concern	*# Drinks	**.61**	**.19**	**<.01**	**.40**	**.15**	**<.01**	.12	.21	.56

Elevated	Main effect	-.34	.40	.39	-.46	.40	.25	.10	.91	.91
SSSS +	*Subj. Intox.	**.18**	**.09**	**.03**	.20	.13	.13	.15	.27	.57
STI	*BAC	**19.7**	**8.80**	**.03**	13.15	7.70	.09	17.42	13.25	.19
Concern	*# Drinks	**.43**	**.15**	**<.01**	**.03**	**.13**	**<.01**	.23	.20	.25
Elevated	Main effect	.64	.46	.17	.60	.46	.19	.35	1.02	.73
SSSS +	*Subj. Intox.	.11	.10	.25	-.15	.16	.34	.08	.33	.82
Elevated	*BAC	13.28	13.26	.32	-2.69	10.34	.80	2.19	21.23	.92
SIS2	*# Drinks	.08	.17	.61	-.10	.14	.48	.04	.24	.86
Elevated	Main effect	-.10	.39	.79	-.21	.40	.59	.77	.92	.40
SSSS +	*Subj. Intox.	.12	.09	.18	.10	.13	.46	.16	.27	.55
Elevated	*BAC	16.50	9.26	.07	9.57	8.04	.23	15.51	14.49	.28
IH	*# Drinks	**.31**	**.14**	**.03**	.24	.13	.07	.07	.20	.74
Elevated	Main effect	-.33	.41	.42	-.37	.41	.37	-.11	.95	.91
SES +	*Subj. Intox.	.11	.09	.22	.07	.13	.59	-.004	.27	.98
HIV	*BAC	6.80	7.38	.36	.90	6.96	.90	23.51	14.43	.10
Concern	*# Drinks	.08	.12	.51	.02	.12	.84	.29	.20	.16
Elevated	Main effect	-.49	.39	.21	**-.81**	**.40**	**.04**	-.27	.93	.77
SES +	*Subj. Intox.	-.03	.08	.76	.08	.13	.56	.30	.28	.29[1]
STI	*BAC	1.92	6.93	.78	.26	6.72	.97	**31.34**	**14.44**	**.03**
Concern	*# Drinks	.01	.12	.95	.03	.11	.77	**.43**	**.21**	**.04**
Elevated	Main effect	.26	.43	.55	.13	.43	.75	.73	.99	.46
SES +	*Subj. Intox.	-.001	.09	.98	.03	.15	.86	.11	.30	.72
Elevated	*BAC	6.63	9.80	.50	1.07	8.58	.90	20.97	17.90	.24
SIS2	*# Drinks	.15	.16	.33	.07	.14	.62	.21	.21	.33
Elevated	Main effect	.26	.43	.55	.13	.43	.77	.73	.99	.46
SES +	*Subj. Intox.	-.002	.09	.98	.03	.15	.86	.11	.30	.72
Elevated	*BAC	6.63	9.80	.50	1.07	8.58	.90	20.97	17.90	.24
IH	*# Drinks	.15	.16	.33	.07	.14	.62	.21	.21	.33

Note. All models included event-level chemsex, alcohol use frequency, and age as covariates except where noted due to failure of model to converge. [1]Model excluded age.

Table 8

Exploratory Analyses of Situation-Level Moderating Excitation/Inhibition Variables

		Penetrative Sex			Condomless Penetrative Sex			Condomless Penetrative Sex + Elevated HIV Risk		
		β	SE	*P*	*β*	SE	*P*	*β*	SE	*P*
PrEP users										
Moderator	Alcohol Variable									
STI concern + attracted to partner	Main effect	.94	.49	.054	.80	.45	.07	-	-	-
	*Subj. Intox.	-.24	.18	.19	.27	.17	.12	-	-	-
	*BAC	**-26.7**	**10.06**	**<.01**	**-18.6**	**9.35**	**<.05**	-	-	-
	*# Drinks	**-.46**	**.18**	**<.05**	-.31	.16	.06	-	-	-
STI concern + desire condomless sensation	Main effect	**1.21**	**.51**	**<.05**	**1.18**	**.47**	**<.05**	-	-	-
	*Subj. Intox.	.29	.20	.16	.21	.19	.28	-	-	-
	*BAC	**-29.5**	**10.28**	**<.01**	**-21.1**	**9.62**	**<.05**	-	-	-
	*# Drinks	**-.65**	**.24**	**<.01**	**-.46**	**.20**	**<.05**	-	-	-
STI concern + desire condomless ejaculation	Main effect	.62	.45	.17	.70	.43	.11	-	-	-
	*Subj. Intox.	-.16	.17	.36	-.11	.17	.51	-	-	-
	*BAC	**-22.4**	**9.26**	**<.05**	-16.4	8.94	.07	-	-	-
	*# Drinks	**-.45**	**.18**	**<.05**	**-.35**	**.18**	**<.05**	-	-	-
Desire condom + attracted to partner	Main effect	.67	.40	.09	**-1.79**	**.44**	**<.001**	-	-	-
	*Subj. Intox.	-.18	.16	.28	-.34	.18	.06	-	-	-
	*BAC	-10.06	8.67	.25	-15.53	9.74	.11	-	-	-
	*# Drinks	-.20	.14	.16	-.22	.15	.13	-	-	-
Desire condom + condomless sensation	Main effect	-.42	.52	.42	-.83	.51	.11	-	-	-
	*Subj. Intox.	-.23	.27	.39	-.32	.29	.27	-	-	-
	*BAC	-14.06	18.13	.44[1]	-10.68	18.89	.57	-	-	-
	*# Drinks	-.45	.30	.13	-.65	.36	.07	-	-	-
Desire condom + condomless ejaculation	Main effect	**-.98**	**.48**	**.04**	**-1.38**	**.49**	**.01**	-	-	-
	*Subj. Intox.	-.15	.19	.42	-.21	.20	.30	-	-	-
	*BAC	1.15	13.08	.93	-3.81	12.69	.76	-	-	-
	*# Drinks	-.26	.21	.21	-.39	-.23	.09	-	-	-
Non-PrEP users										
STI concern + attracted to partner	Main effect	.20	.41	.63	-.16	.39	.68	-.38	.76	.62
	*Subj. Intox.	-.06	.16	.71	.02	.15	.89	.06	.29	.85[1]
	*BAC	-3.89	7.20	.59	-2.43	7.08	.73	-18.52	11.04	.09
	*# Drinks	-.02	.14	.89	.02	.13	.87[1]	-.15	.16	.35
STI concern + desire condomless sensation	Main effect	.01	.43	.99	-.17	.42	.69	-.54	.80	.50
	*Subj. Intox.	.10	.19	.59	.07	.17	.68	-.17	.29	.55
	*BAC	30.71	19.55	.12[1]	15.96	11.48	.16	-11.84	15.72	.45
	*# Drinks	.36	.22	.11	.22	.17	.19	-.06	.20	.74
STI concern + desire condomless ejaculation	Main effect	-.38	.39	.33	-.58	.39	.13	.47	.80	.56
	*Subj. Intox.	-.02	.16	.92	.01	.16	.95	-.48	.35	.17
	*BAC	14.71	10.87	.18	11.18	9.35	.23	**-28.47**	**12.63**	**.02**
	*# Drinks	.15	.15	.33	.09	.14	.49	**.39**	**.17**	**.02**
Desire condom +	Main effect	**-.99**	**.39**	**.01**	**-2.37**	**.41**	**<.001**	-1.81	1.03	.08
	*Subj. Intox.	-.21	.14	.13	-.04	.14	.76	.63	.36	.08

attracted to partner	*BAC	-6.26	7.42	.40	9.18	9.05	.31	-10.95	11.33	.33
	*# Drinks	-.10	.13	.41	.17	.14	.23	-.03	.18	.88
Desire condom + condomless sensation	Main effect	-.70	.47	.14	**-1.61**	**.49**	**<.001**	-1.95	1.31	.14
	*Subj. Intox.	.01	.17	.93	.004	.16	.98	.24	.35	.49
	*BAC	7.70	12.36	.53	9.41	11.51	.41	11.09	21.81	.61
	*# Drinks	.20	.19	.31	.22	.18	.23	.49	.39	.22
Desire condom + condomless ejaculation	Main effect	-.62	.42	.14	**-2.02**	**.46**	**<.001**	-2.32	1.31	.09
	*Subj. Intox.	-.19	.16	.25	.01	.16	.97	.38	.41	.35
	*BAC	-3.07	8.31	.71	2.54	8.81	.77	-16.96	12.36	.17
	*# Drinks	-.07	.15	.62	.10	.17	.57	-.16	.21	.46

Note. All models included event-level chemsex, alcohol use frequency, and age as covariates except where noted due to failure of model to converge. [1]Model excluded age.

Figure 1

Interactive Effects of Number of Drinks and PrEP Use on PS

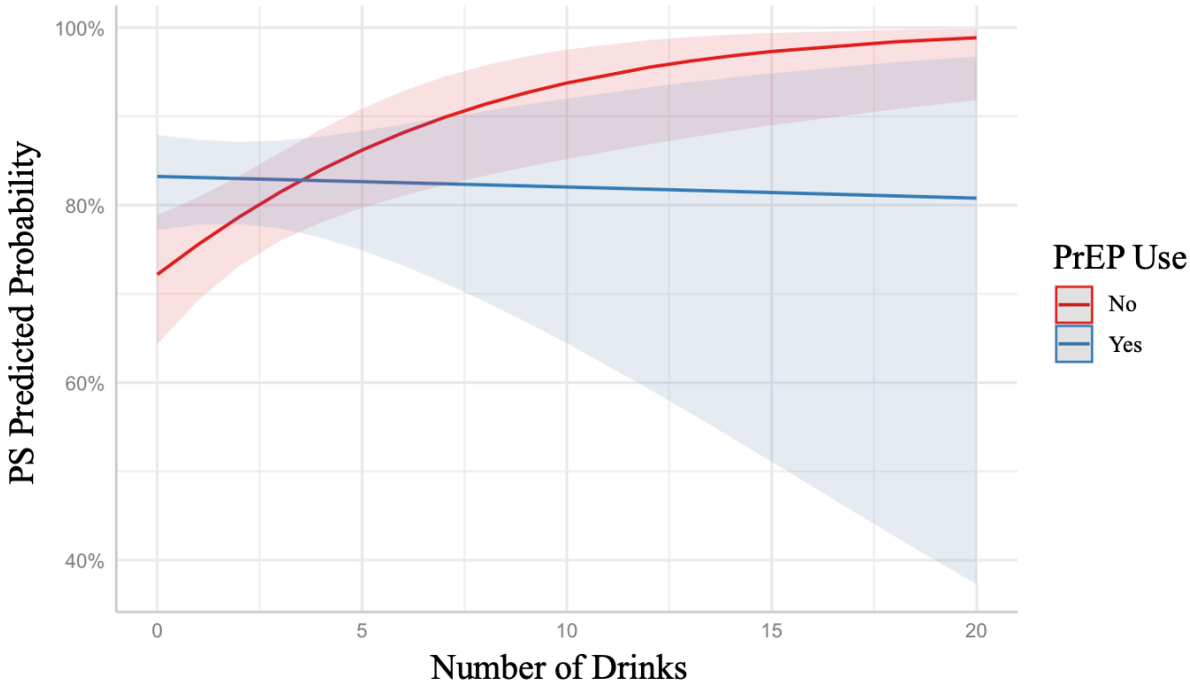


Figure 2

Interactive Effects of Subjective Intoxication and PrEP Use on CPS

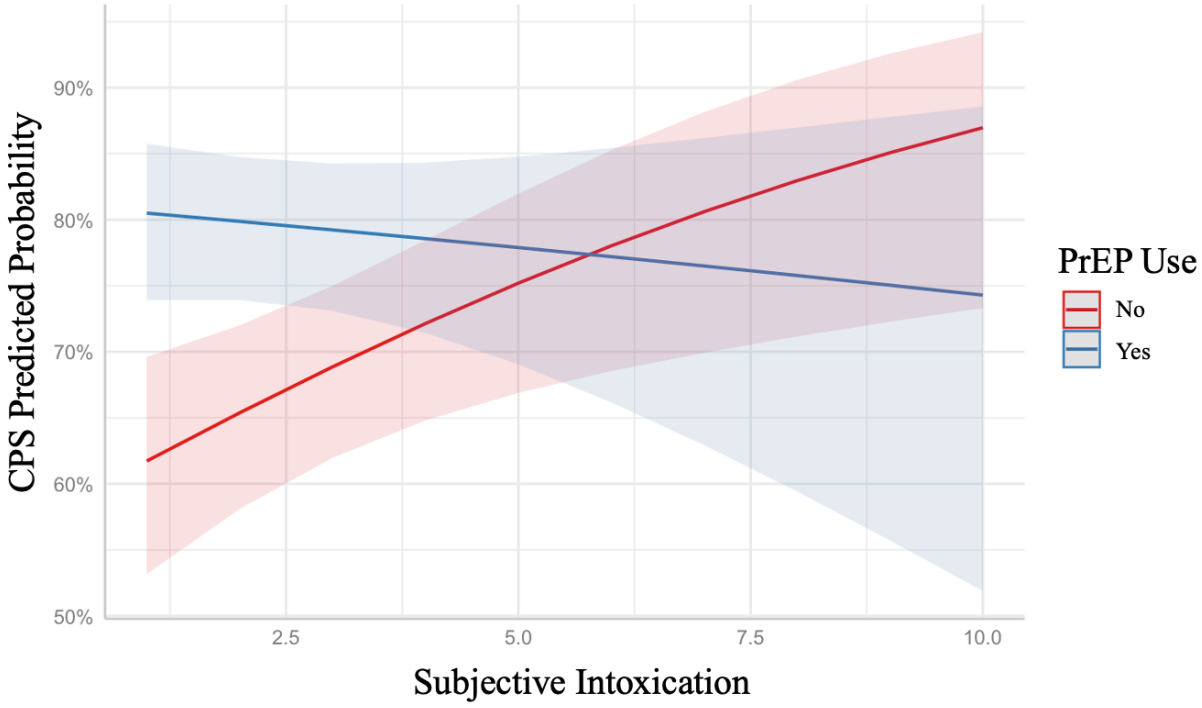


Figure 3

Interactive Effects of BAC and PrEP Use on CPS

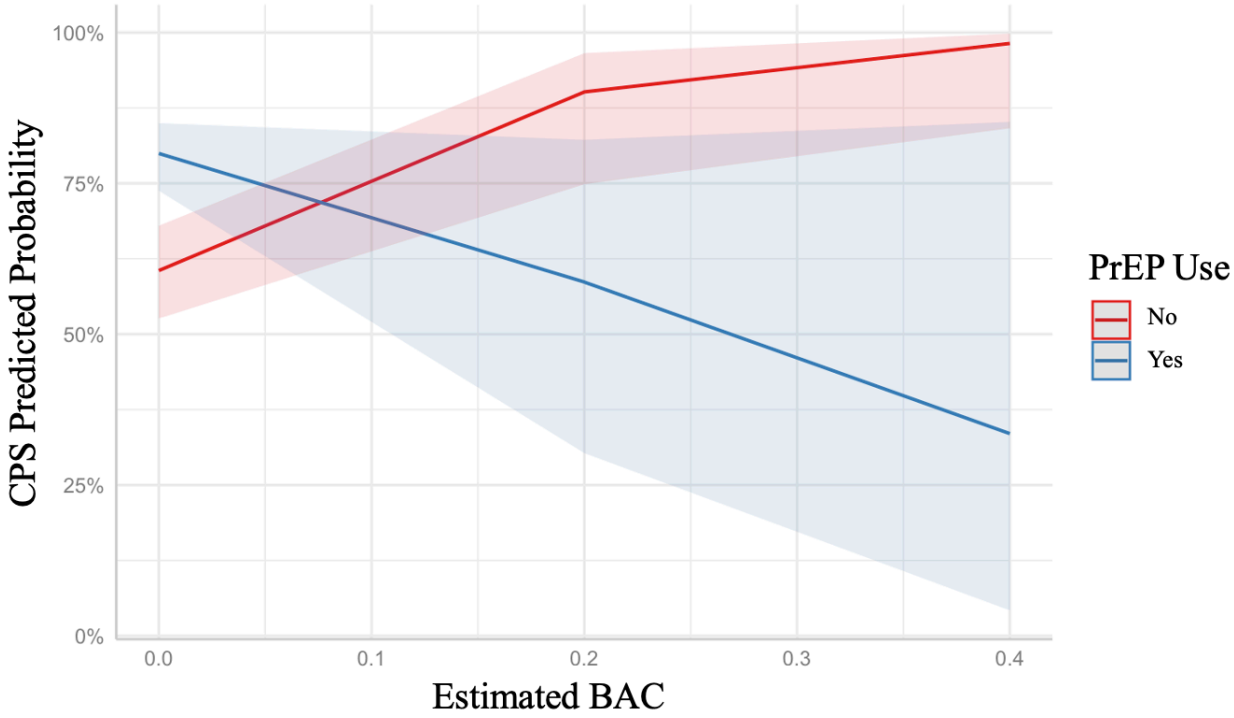


Figure 4

Interactive Effects of Number of Drinks and PrEP Use on CPS

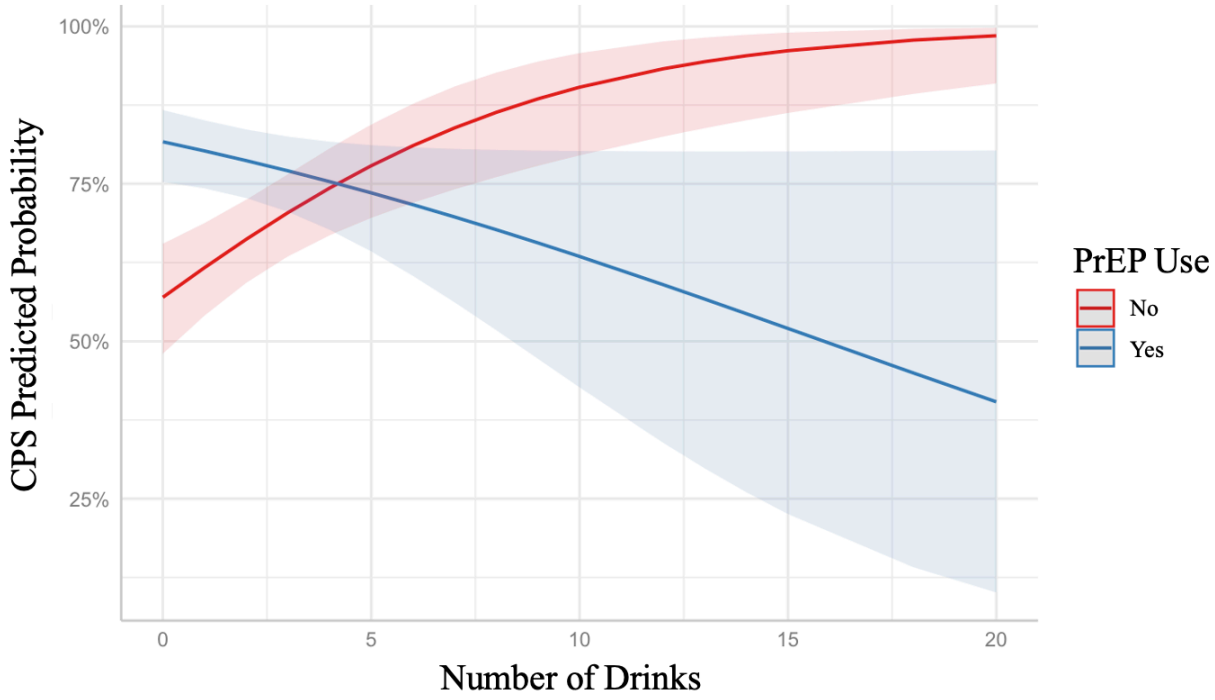


Figure 5

Interactive Effects of Chemsex and HIV Protection on CPS

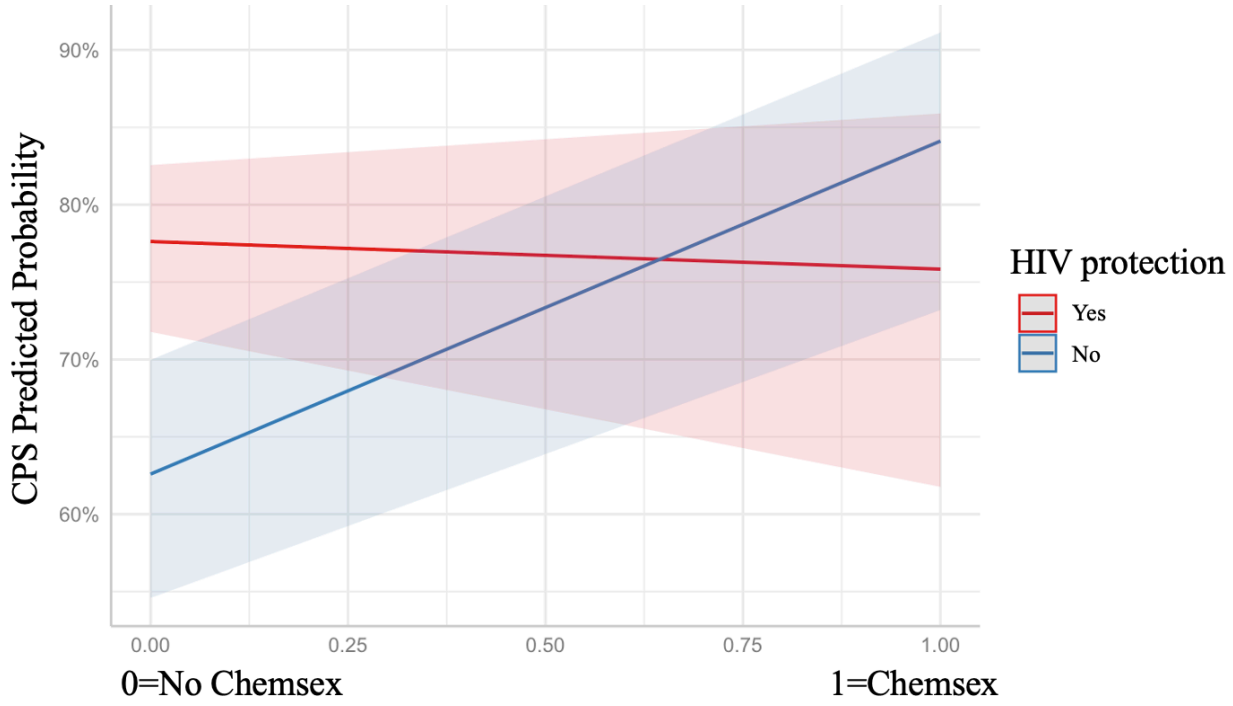


Figure 6

Interactive Effects of Subjective Intoxication and SSSS+HIV Concern Inhibition Conflict on PS

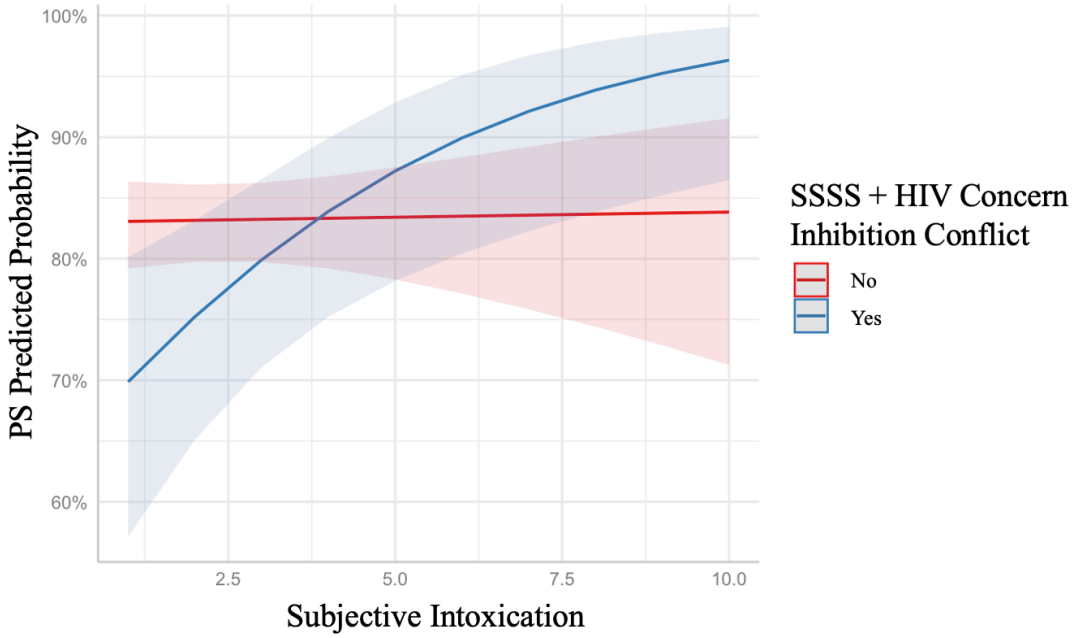


Figure 7

Interactive Effects of Number of Drinks and SSSS+HIV Concern Inhibition Conflict on CPS

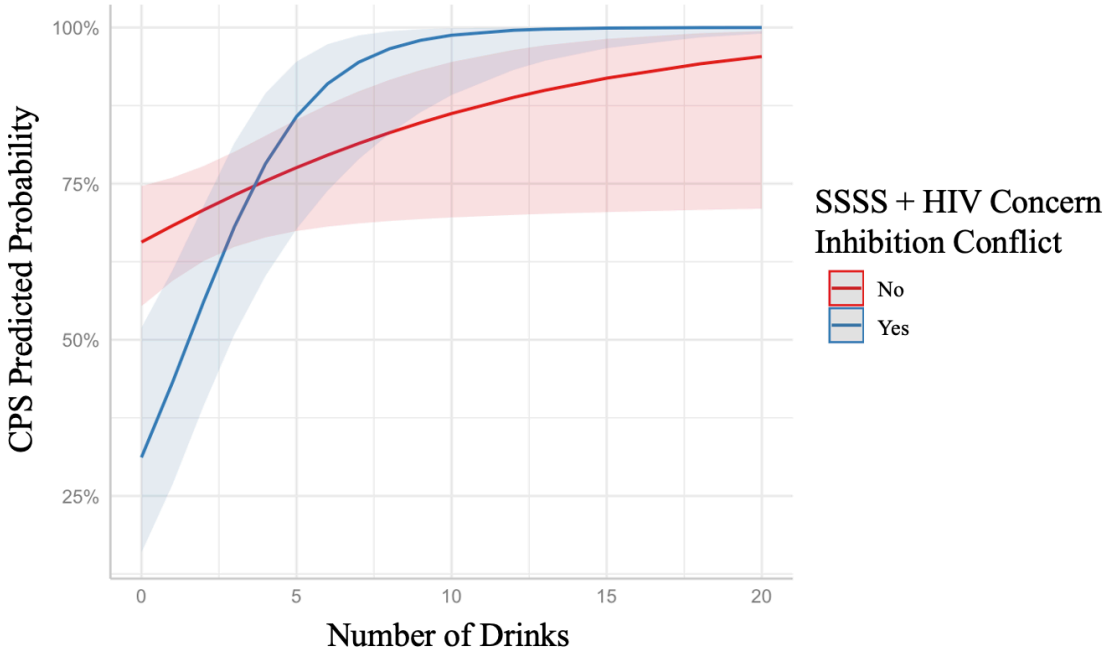


Figure 8

Interactive Effects of Number of Drinks and STI Concern + DCS Inhibition Conflict on CPS

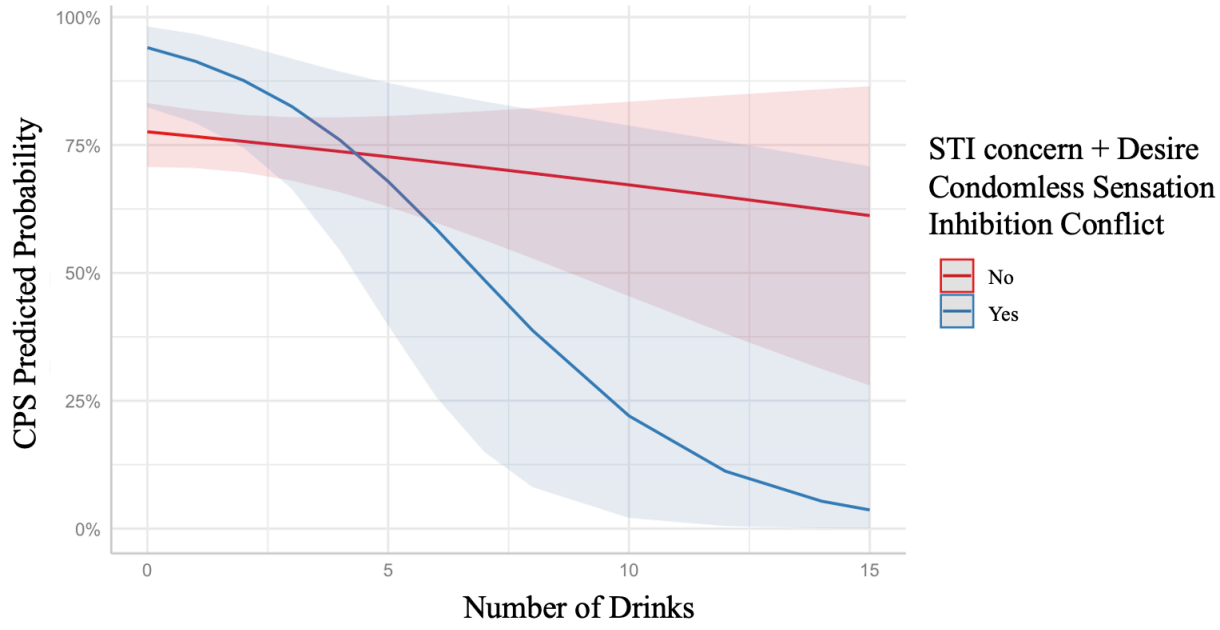
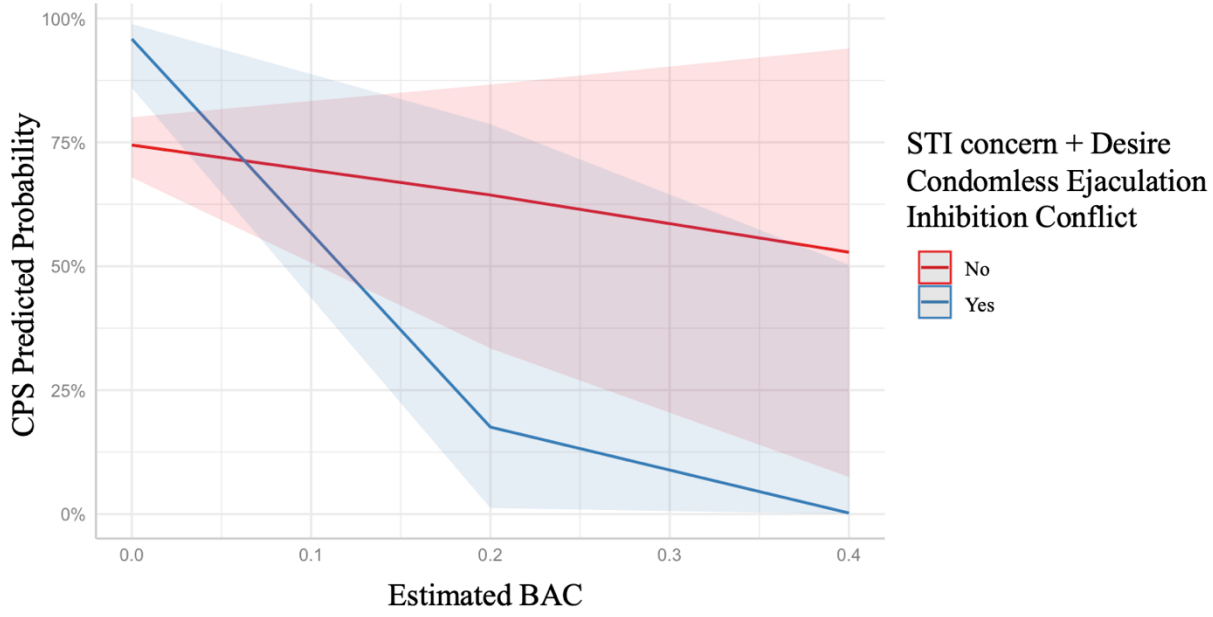


Figure 9

Interactive Effects of BAC and STI Concern + DCE Inhibition Conflict on CPS



Convergence and Disagreement Between Qualitative and Quantitative Findings: Putting the Pieces Together

General Discussion

The above studies sought to explore the associations between alcohol intoxication and sexual risk behavior using a mixed-methods approach. Analyses for the quantitative study were guided by results of the qualitative study and can now be interpreted in the context of the qualitative data. The process of assessing research questions with both qualitative and quantitative data is a synergistic process that allows for the inferences of each method to be strengthened by the other (Brown et al., 2015). The findings of the qualitative and quantitative data provide both points of convergence and points of disagreement, which allows for a richer interpretation of these results.

First, a key finding of the quantitative study was that PrEP non-users showed effects of alcohol on sexual risk behavior while PrEP users did not. The fact that few participants in the qualitative study were HIV-negative and not using PrEP limits the ability to ask this same research question with the interview data. However, there were conflicting findings between the quantitative and qualitative studies regarding the effects of alcohol on PrEP users. While the quantitative study did not observe effects, several interview participants who use PrEP reported effects of alcohol on their sexual risk behavior. However, many of these participants discussed alcohol's effects on partner selection and communication rather than condom use and anal sex. It may be that alcohol affects sexual risk in PrEP users, but it has less of an effect on condom use and anal sex. Therefore, the reason for non-significant findings among PrEP users in the quantitative study may be due to the focus on condom use and anal sex. If the quantitative study

investigated other sexual risk behaviors, it may have found effects of alcohol on these behaviors for PrEP users.

Second, the distinguishing factor between interview participants who did and did not report alcohol effects was concern about HIV/STIs, while the distinguishing factor in the quantitative study was PrEP use. It could be assumed that the reason for differences between PrEP users and non-users was differences in STI concern, but bivariate correlations indicated that PrEP use was not associated with STI concerns. In addition, the moderating effects of PrEP use remained significant after controlling for HIV concern. This discrepancy between the qualitative and quantitative data could be due to several factors. First, HIV concern may have been inadequately assessed in the quantitative study (i.e., one item with a 4-point scale), and therefore may not have captured how PrEP use affects one's perceived risk of STIs with condomless sex. Alternatively, the qualitative study lacked participants who were not on PrEP, and therefore key information may be missing.

Despite these two points of disagreement, the qualitative and quantitative findings converge when it comes to the moderating effects of STI concerns. In the quantitative study, participants who were not using PrEP and scored high on both sexual sensation seeking and HIV/STI concerns showed a particularly strong relationship between alcohol intoxication and sexual risk behavior. Many interview participants described conflict similar to this, where their interest in new and exciting sexual experiences came into conflict with their concerns about STIs. These participants were also very likely to report effects of alcohol, although the majority of them were PrEP users. This suggests that inhibition conflict factors may also moderate alcohol effects for PrEP users, but that greater power may be needed to detect these effects.

Ultimately, one of the lessons learned from this research is the value of conducting mixed-methods studies sequentially. If the results of the qualitative study had been obtained prior to the launch of the quantitative study, there would likely have been several changes to the survey. First, assessment of partner familiarity would have been strengthened, assessing for factors like perceived trust and open communication. The survey would have also more thoroughly assessed for STI concerns, for instance, distinguishing between perceived risk of getting an STI and perceived negative consequences of getting an STI. It also would have attempted to distinguish between concerns related to health consequences and stigma. Finally, the survey would have included more thorough assessment of additional sexual risk behaviors at the event level, such as asking about whether the person communicated their preferences for condom use prior to the encounter or screened the partner for STI risk. Making these changes would have allowed the survey to directly follow-up on the findings of the qualitative interviews.

If, on the other hand, quantitative analyses had been completed first, several changes would have been made to the recruitment efforts and interview questions for the qualitative study. Frist, greater efforts would have been made to recruit HIV-negative participants not on PrEP and HIV-positive participants with detectable viral loads. Because the quantitative survey showed these participants to be more susceptible to the effects of alcohol on sexual risk behavior, the interviews would have provided an opportunity to follow up on these findings and explore which characteristics may have caused these effects. In addition, the interviews would have included questions about how PrEP use and viral load affects their perceptions of condomless sex, and how their perceptions changed after getting on PrEP or achieving an undetectable viral load.

Despite these missed opportunities, there was still value in conducting these studies in parallel. Doing simultaneous mixed-methods data collection and analyses allowed for a greater appreciation of how these drastically different methods can help researchers to approach a problem from many different sides at once. Analyzing the qualitative data prior to the quantitative data allowed for the interview findings to inform the analysis models chosen for the quantitative study. Conducting these studies in parallel also allowed for greater reflection on the meaning of the results and added nuance to the discussion of future research directions. Mixed methods are an underutilized methodology in research on substance use and sexual behavior, and future research should take advantage of this powerful tool to answer the yet-unanswered questions in this burgeoning field.

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