Evaluating the Self-Medication Hypothesis: Within- and Between-Person Variability in Mood, Stress, and Drinking to Cope

Evaluating the Self-Medication Hypothesis: Within- and Between-Person Variability in Mood, Stress, and Drinking to Cope

by

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ABSTRACT

Sexual assault is a significant problem for college women. The self-medication hypothesis frames post-assault alcohol use as a strategy to cope with stress and negative mood. This thesis examined how alcohol use coping motives mediate the relationship between daily fluctuations in stress and negative mood and subsequent alcohol consumption in women with sexual assault histories who are heavy drinkers. Although Bayesian multilevel models did not support the between-person mediation pathways, within-person mediation was supported for negative mood, such that increases in negative mood predicted greater alcohol use coping motives, which in turn predicted greater alcohol use. Together, these findings offer event-level evidence that negative mood operates as a proximal predictor of alcohol use via alcohol use coping motives. By demonstrating the importance of state-level negative mood as a proximal predictor of alcohol use via alcohol use coping motives, these results underscore the importance of interventions that reduce in-the-moment negative mood.

INDEX WORDS: Sexual assault, Alcohol use, Self-medication

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DEDICATION

This work is dedicated to the people who carried me through this process. Graduate school is undoubtedly challenging, particularly while working toward major milestones such as a thesis. I would not have been able to complete this without the unwavering support, patience, and joy provided by the people in my life. I would like to extend a special thank you to my sister, Taylor, for her encouragement and support throughout this process. To Mikel, my partner and friend, thank you for your unwavering support, patience, and belief in me every step of the way. And to my friends, Grace, Ashley, and Olivia, thank you for your friendship, laughter, and support throughout this process.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

1.1 Sexual Assault and Negative Sequalae

Sexual assault is a major public health issue that impacts individuals globally (Basile & Smith, 2011). Sexual assault refers to any nonconsensual sexual act, including sexual penetration and non-consensual contact such as sexual touching, proscribed by Federal, tribal, or State law, including when the victim[1] is unable to consent (Office on Violence Against Women, 2023). These sexual acts can consist of contact between the penis and the vulva or anus; contact between the mouth and the penis, vulva, or anus; or penetration of the anal or genital opening of another person by a hand, finger, or other object (National Sexual Violence Resource Center, n.d.). General population estimates of nonconsensual sexual contact alone range from 2 to 34%, with an average estimate of 20% (Fedina et al., 2018).

College campuses are a setting of special concern for the high incidents of sexual assault (Fedina et al., 2018). College aged women are four times more likely to be sexually assaulted than women in any other age group (U.S. Department of Justice, 2014). Further, women enrolled in college are at greater risk of sexual assault than women who are not enrolled (American Association of University Professors, 2012). Estimations are that 20 to 75% of women experience some form of sexual assault on campus (Abbey et al., 2005; Krebs et al., 2007), most often the offender is someone that the woman already knows (Fisher et al., 2003; Kilpatrick et al., 2007; Tjaden & Thoennes, 2006). However, many assaults are never reported or may be

[1] Victim is the legal term used to refer to people who have experienced sexual assault (Rape, Abuse, & Incest National Network [RAINN], 2009), however it is also common to refer to people who experienced sexual assault as survivors (RAINN, 2009; Williamson & Serna, 2018). As personal preference may vary (Williamson & Serna, 2018), the terms will be used interchangeably to follow best practices (Sexual Assault Kit Initiative, n.d.).

inconsistently counted as official, thus campus sexual assault rates may be an underestimation (American Association of University Professors, 2012).

There are multiple factors that are associated with the increased risk in women experiencing sexual assault between 18 to 24 years old and when enrolled in college. College campuses have been identified as risky because heavy drinking is part of the social milieu and alcohol is often readily available (Lorenz & Ullman, 2016). Campus norms of parties and "hookups" typically involve the expectation of excessive alcohol consumption, both directly and indirectly increasing risk of sexual assault (Armstrong et al., 2006; Cranney, 2015; Flack et al., 2016). Risk can be impacted by factors such as year in school, sexual and gender identity, and race. Indeed, there are factors – both individual and contextual – that can exacerbate one's risk of experiencing sexual assault. Moreover, alcohol is involved in an estimated 75% of sexual assaults (Mohler-Kuo et al., 2004). At the campus level, individuals are at greater risk of sexual assault at schools with medium to high rates of heavy episodic drinking (HED), defined as consuming 4 or more drinks within 2 hours for women (National Institute on Alcohol Abuse and Alcoholism, 2025) compared to schools with lower rates of HED (Mohler-Kuo et al., 2004). At the individual level, alcohol use is consistently identified as a factor that increases vulnerability to sexual assault. Acute intoxication may impair risk perception, reduce the ability to detect danger cues, and limit the capacity to resist or exit unsafe situations (Davis et al., 2009; Kaysen et al., 2006). Alcohol use by perpetrators is also associated with an increased likelihood of aggression, misperception of sexual intent, and reduced inhibition, all of which elevate assault risk (Hammett et al., 2025; Neilson et al., 2025).

Of concern are the psychological sequelae post-assault that can adversely impact trajectory of recovery and well-being. Negative mood is one of the most frequently reported

psychological difficulties experienced by women post-assault (Sarkar & Sarkar, 2005). Also common following a sexual assault is reports of acute stress (Garcia-Esteve et al., 2021). One study projected that 24% of women with sexual assault histories have full acute stress disorder and 21% have subclinical acute stress disorder (Sarkar & Sarkar, 2005). Experiences of sexual assault are associated with lower psychosocial functioning and persistent impacts on mental health (Dworkin, 2021; Dworkin et al., 2017; Rothman et al., 2019). Further, sexual assault is associated with an increased likelihood of symptoms of anxiety, depression, disordered eating, obsessive-compulsive disorder, bipolar disorder, trauma–related disorders such as posttraumatic stress disorder (PTSD), and alcohol dependence (Campbell et al., 2009; Dworkin et al., 2017; Dworkin, 2021). Women who experience sexual assault are also at a greater risk for sleep disorders and nightmares (Sarkar & Sarkar, 2005). When compared to women without sexual assault histories, survivors are at greater risk for pain, somatic symptoms (e.g., headaches), chronic health problems (e.g., chronic pain), sexually transmitted diseases, and lower health-related quality of life (Amar & Gennaro, 2005; Sadler et al., 2000; Schou-Bredal et al., 2020; Ulrisch et al., 2014).

Sexual assault experiences can negatively impact a broad range of functioning even beyond mental and physical health. In college, individuals with sexual assault histories are more likely to experience difficulties with motivation to learn, have lower grade point averages, and are at great risk of dropping out of university (Molstad et al., 2021). Survivors of sexual assault may also experience difficulties with their romantic and dating experiences. Indeed, women with sexual assault histories are more likely to experience diminished sexual urge or lose satisfaction and pleasure with sexual activities (Sarkar & Sarkar, 2005; van Berlo & Ensink, 2000). Posttraumatic stress disorder (PTSD) symptoms in particular could impact dating relationships

after sexual assault in which it is suggested that communication difficulties could increase relationship stress (DiMauro & Renshaw, 2019). Women frequently face a complicated path in recovery and coping following a sexual assault, with self-blame and shame prevalent (Swanson & Szymanski, 2022). Confidence in their ability to cope with their trauma can exacerbate psychological distress, such as with PTSD symptom severity (Swanson & Szymanski, 2022). Further, they may have difficulties coping with negative emotions as a result of the assault, such as fear (Marx et al., 2005).

1.2 Help Seeking After Sexual Assault

Typically, distress decreases within the first few months post-sexual assault, however many victims will continue to experience psychopathology and distress longer-term (Rothbaum et al., 1992; Pacella et al., 2012; Surìs et al., 2007). Although interventions may help reduce this distress (Kearns et al., 2012), most survivors of sexual assault will not seek formal help (Campbell et al., 2001; Campbell, 2008; Kimerling & Calhoun, 1994; Patterson et al., 2009; Ullman, 2007). The underreporting of sexual assault may result in less connections to formal support systems that could provide intervention. Among college students, only 12.5% of rapes were reported to crisis centers, school officials, helplines, hospitals, health centers, or police (Krebs et al., 2016). Ethnic minority women are less likely to seek help than white women (Ullman, 2007) contributing to health disparities. Further, many help seeking behaviors are influenced by commonly held rape myths, including that the sexual assault needs to be severe enough, often involving physical injuries, threats of force, actual force, or offender use of weapons (Campbell et al., 2009; Fisher et al., 2003; Kilpatrick et al., 2007; Krebs et al., 2016; Patterson et al., 2009; Tjaden & Thoennes, 2006). Potentially influencing rates of underreporting,

over 60% of women do not label their experience as sexual assault despite their experience meeting legal definitions (Harned, 2005; Littleton & Henderson, 2009), which then also influences their likelihood to seek help (DeLoveh & Cattaneo, 2017). There are many additional factors that are associated with reduced help-seeking, such as self-blame (e.g., if the survivor feels that they did not resist enough during the assault; Campbell et al., 2009), shame (e.g., embarrassment over experiencing assault; DeLoveh & Cattaneo, 2017), knowing the offender (Fisher et al., 2003), involvement of alcohol (Fisher et al., 2003; Kilpatrick et al., 2007), and negative reactions from family or friends (Campbell, 2008; Ullman et al., 2008).

In the absence of healthy coping strategies or better alternatives, such as those gained through formal interventions, women may adopt maladaptive behavioral and cognitive coping strategies to reduce their distress (Littleton et al., 2009; Walsh et al., 2010). Coping generally refers to the ways in which individuals manage the demands created by stressful life experiences when they exceed their personal resources (Lazarus & Folkman, 1984). For example, victims of sexual assault often turn to internal strategies to manage their distress, such as engaging in avoidance, being more guarded, minimizing their experience, or trying to rationalize the offender's behavior (DeLoveh & Cattaneo, 2017). These maladaptive coping strategies can protect women from the realities and the distress of their trauma; however, avoidant coping strategies are associated with greater severity of PTSD symptoms (Badour et al., 2012; Tipsword et al., 2022; Pineles et al., 2012). As such, maladaptive strategies may be a barrier to recovery (Gutner et al., 2006; Ullman et al., 2007). One common form of maladaptive avoidant coping strategy is using alcohol to reduce distress (DeLoveh & Cattaneo, 2017).

1.3 Self-Medication Hypothesis

The self-medication hypothesis, derived from clinical observations of individuals in substance use treatment, suggests that people use drugs to regulate negative internal experiences (Khantzian, 1997). For these individuals, substances act as short-term negative reinforcers. That is, substance use is reinforced because it reduces negative mood states and distress, increasing the likelihood that individuals will continue to cope with distress by drinking (Baker et al., 2004). Although substances may be effective initially in alleviating distress, over time, tolerance develops, resulting in diminished effects and neurochemical changes that reduce alcohol's effectiveness to manage distress and lead to an increased likelihood of heavy drinking and alcohol-related problems (Blume et al., 2000).

The self-medication hypothesis has been studied in various conditions, such as depression and anxiety (Hall & Queener, 2007), with estimates indicating that 21.9% of individuals use alcohol and/or drugs to relieve symptoms of depression and anxiety or to feel better (Turner et al., 2018). Research has also assessed the self-medication hypothesis in women with sexual assault histories because of the link between such histories and alcohol use (Bedard-Gilligan et al., 2011; Griffin & Read, 2012; Hahn et al., 2019; Littleton et al., 2009; Lorenz & Ullman, 2016; McCauley et al., 2009; Ullman et al., 2013), specifically excessive and maladaptive patterns of alcohol use (Miranda et al., 2002). High rates of sexual assault are identified in women seeking substance abuse treatment (Dansky et al., 1995).

Emotion regulation plays a key role in the self-medication hypothesis. Individuals with lower emotion regulation abilities are more likely to engage in substance use (Mahoney et al., 2023). This is particularly true for central nervous system depressants like alcohol, which are often used for emotion inhibition (McKernan et al., 2015). Alcohol, for example, is commonly

used for self-medication, with prevalence rates of 10-20.8% in people with anxiety disorders (Turner et al., 2018) and 14.4% in people with PTSD (Leeies et al., 2010). Alcohol's appeal may stem from its ability to create an illusion of relief by reducing feelings of isolation and emptiness (Khantzian, 1997). Biologically, the appraisal-disruption model proposes that alcohol impairs cognitive functions related to the appraisal of stressful situations, preventing the activation of stressful memories (Sayette, 1999). This suggests that the timing of alcohol use may be critical, as individuals might consume alcohol before potentially distressing encounters. Stress is often defined as the appraisal of an event as harmful (Lazarus & Folkman, 1984), and alcohol's appraisal-disruption effects could explain its use during stressful times. Additionally, alcohol increases dopamine and serotonin, "happy hormones" that provide temporary relief during distress (Yoshimoto et al., 1992). Since dopamine receptors in the medial prefrontal cortex are implicated in PTSD development (Kredlow et al., 2021), alcohol's impact on these receptors (Trantham-Davison et al., 2014) may offer relief by disrupting fear processing, which is particularly relevant for individuals with trauma histories. According to Khantzian's (1999) self-medication hypothesis, greater substance use is associated with negative affect, reinforcing the idea that people use substances to manage negative emotions.

Women with sexual assault histories are particularly vulnerable to drinking to cope with distress or negative emotions, as a history of sexual assault is linked to increased psychological distress and the use of alcohol as a form of negative reinforcement (Miranda et al., 2002). Indeed, compared to women with a history of sexual assault without problematic drinking, women with sexual assault histories who do engage in problematic drinking are more likely to use alcohol as a means to reduce stress (Smith et al, 2014). Women may also use alcohol to relieve sexual inhibition and increase sexual desire following sexual assault (Sanjuan et al.,

2009). Alcohol consumption among survivors of sexual assault is negatively reinforced by decreasing anxiety and distress (Miranda et al., 2002), further supported by evidence showing that the severity of sexual assault is indirectly linked to drinking to cope with anxiety through PTSD symptoms (Kilimnik et al., 2023). Additionally, drinking to cope has been shown to partially mediate the relationship between PTSD and problematic drinking (Ullman et al., 2013). On an event level, greater endorsement of PTSD symptoms is associated with greater alcohol use in individuals with coping drinking motives (Dworkin et al., 2021; Simpson et al., 2014), with event-level analyses supporting the idea that sexual assault survivors engage in problematic drinking to downregulate negative emotions (Stappenbeck et al., 2023). This aligns with a broader review of event-level drinking motives, which found support for the motivational model, showing that individuals with more negative affect tend to endorse greater drinking to cope (Votaw & Witkiewitz, 2021).

Furthermore, drinking to cope with sex-related distress has been identified as a mediator between sexual assault-related distress and sexual consequences in women who drink before sexual activity (Bird et al., 2022). In women with low coping control, greater distress on certain days is associated with increased alcohol consumption, whereas average levels of distress were not associated with greater drinking, highlighting the importance of examining stress and drinking at the event level (Stappenbeck et al., 2015). Indeed, alcohol, often used to inhibit emotions when adaptive coping methods are lacking (McKernan et al., 2015), may be particularly appealing during periods of anxiety and stress. Women with sexual assault histories may turn to alcohol as a way to regain control over their circumstances (Guggisberg, 2012). Path analyses show that a history of sexual assault significantly predicts higher distress levels, which are then linked to greater alcohol use through negative reinforcement (Miranda et al., 2002).

Event-level analyses further support that women drink alcohol to reduce negative emotions, consistent with the self-medication hypothesis (Stappenbeck et al., 2022). However, while stress has been shown to impact alcohol use, the role of stress in women with sexual assault histories remains understudied. Although PTSD has been widely examined in relation to alcohol use (Hawn et al., 2020), stress more generally has not been fully explored despite evidence that different types of stress can influence alcohol use in various ways (Keyes et al., 2012). Expanding the examination of the self-medication hypothesis to include broader stressors within the self-medication hypothesis could deepen our understanding of how women with sexual assault histories use alcohol to cope. However, alcohol use is not driven solely by attempts to reduce negative affect. The motivational model of alcohol use distinguishes between coping motives (drinking to reduce stress) and enhancement motives (drinking to increase positive affect or excitement; Cooper, 1994). Whereas coping motives are linked to negative reinforcement processes as noted above, enhancement motives reflect positive reinforcement and are more strongly associated with sensation-seeking and social reward (Cooper, 1994). Distinguishing between these motives is crucial when testing the self-medication hypothesis, as coping motives should be specifically driven by increases in stress and negative mood, whereas enhancement motives should be less influenced by distress-driven fluctuations.

It is crucial to recognize that most research on the self-medication hypothesis has utilized longitudinal or cross-sectional designs. Although these approaches have provided important information about associations among stress, negative affect, and alcohol use, they often often overlook the real-time dynamics of alcohol use in response to distress especially for individuals with trauma histories, such as women who have experienced sexual assault. Event-level analyses offer the opportunity to capture the situational triggers and immediate contexts in which alcohol

use occurs, providing a more nuanced understanding of the specific moments when individuals turn to alcohol to cope with distress or negative affect. Event-level methods also provide a more fine-grained and ecologically valid understanding of how stress, mood, and alcohol use unfold in naturalistic settings. Unlike cross-sectional studies that assess behavior at a single time point, and unlike longitudinal surveys that examine change across broader intervals such as weeks or months, daily diary approaches can detect within-person fluctuations over time while reducing recall bias. The importance of this level of analysis lies in the variability of alcohol use across different events or days. For instance, women may not always use alcohol in response to general levels of stress but might drink more heavily on days when stress or trauma-related distress is particularly acute (Stappenbeck et al., 2015). This highlights the significance of pinpointing when and why alcohol use is employed as a coping strategy, as well as the role of fluctuations in mood and stress. Without event-level analyses, it is challenging to differentiate between consistent patterns of problematic drinking and instances where alcohol is used specifically to manage distressing emotions or memories. Furthermore, as people's experiences, emotions, and behaviors fluctuate day-to-day, it is important to consider the differential impact variations in stress and mood may have on alcohol consumption. This distinction is critical for understanding how coping motives operate in real time and for developing targeted interventions that address these acute episodes of distress. Moreover, given that previous research has found variability in coping motives based on daily affect (Votaw & Witkiewitz, 2021), examining these patterns at an event level could clarify the conditions under which the self-medication hypothesis holds true.

1.4 Goals and Hypotheses

To address the limitations in understanding the self-medication hypothesis among women with sexual assault histories, this project involves secondary analyses of data from a larger study

in which heavy drinking college women with sexual assault histories were recruited to participate in a randomized controlled trial of a web-based intervention that included emotion regulation skills and alcohol reduction strategies compared to an assessment-only control. The present project utilizes daily diary data, which women completed once per day for 14 days during the time women randomized to the intervention condition received the skill modules. By leveraging event-level data in this high-risk sample, the present study extends prior work by testing whether day-to-day fluctuations in negative mood and stress are associated with drinking through coping motives, while also distinguishing within-person from between-person effects and evaluating the specificity of this pathway relative to enhancement motives.

The present study has two primary goals: Aim 1) to distinguish the within-person effects (i.e., *intra-individual variability*, how overall levels of mood and stress impact drinking motives and behavior on average) from the between-person effects (i.e., *inter-individual variability*, how day-to-day variations in stress and mood influence drinking motives and behavior) of mood and stress on drinking motives and number of standard alcoholic drinks consumed on drinking days; and Aim 2) to examine whether coping drinking motives mediate the relationship between fluctuations in negative mood and stress and the subsequent number of standard alcoholic drinks consumed, and to test the specificity of this self-medication pathway by comparing effects from a model with coping drinking motives to one with enhancement drinking motives. Including enhancement motives as a comparison allows for evaluation of whether alcohol use reflects a self-medication process rather than a general tendency to drink for pleasure. Findings from this study could inform interventions aimed at reducing drinking by targeting motives that drive alcohol use in this high-risk group.

H1a. There will be a positive within-person association between stress and negative mood and alcohol use, such that on days when individuals report higher negative mood or stress than is typical for them, they will also report stronger coping motives and greater alcohol consumption.

H1b. There will be a positive between-person association between stress and negative mood and alcohol use, such that individuals with higher average levels of negative mood or stress across the study period will report stronger coping motives and greater alcohol consumption than individuals with lower average levels.

H2a. Coping drinking motives will mediate the relationship between negative mood and alcohol consumption, such that on drinking days when an individual reports higher negative mood than their typical level, they will also report stronger coping drinking motives, which in turn will be associated with consuming a greater number of standard drinks.

H2b. Coping drinking motives will mediate the relationship between stress and alcohol consumption, such that on drinking days when an individual reports higher stress than their typical level, they will also report stronger coping drinking motives, which in turn will be associated with consuming a greater number of standard drinks.

H2c. Enhancement motives will not significantly mediate the relationship between daily fluctuations in negative mood and stress and alcohol consumption, such that on drinking days when an individual reports higher negative mood or stress than their typical level, enhancement motives will not significantly predict subsequent alcohol consumption, supporting a self-medication-specific process rather than a general motivation-to-drink mechanism.

2 METHODS

This study involves a secondary analysis of data that were collected from 2017-2019 from a sample of 200 women who were heavy drinkers with sexual assault histories (NCT ID NCT03111056). The daily diary data utilized in the present study have not been published elsewhere. Inclusion criteria for this study were that participants were female, 18 years or older, had a lifetime history of sexual assault (defined as unwanted attempted or completed oral, vaginal, or anal penetration but excluding unwanted sexual contact only), at least two instances of heavy episodic drinking (defined as 4 or more drinks in 2 hours) in the past 30 days, and an average consumption equal or greater than 7 drinks per week in the past 30 days. There were no exclusion criteria for this study. These 200 women were randomly assigned to either a web-based intervention to reduce heavy drinking (n = 100) or were assigned to a non-treatment control condition (n = 100). The women in this study completed daily diary surveys for a total of 14 days with an average completion rate of 66.2%. Following exclusions for missing data, the total analytic sample is 170 women (control n = 85; treatment n = 85).

2.1 Participant Characteristics

The average age of the sample was 20.9 years (SD = 2.91). For racial and ethnic demographics, the sample was primarily Caucasian/White (n = 129, 68.3%), followed by Asian/South Asian (n = 26, 13.8%) and Multi-Racial (n = 24, 12.7%) (See table 1). Smaller proportions of the sample identified as Black/African American (n = 2, 1.1%), Native American/American Indian/Alaska Native (n = 2, 1.1%), or Other (n = 2, 1.1%), with three participants not reporting their race (n = 3, 1.6%). Most participants identified as non-Hispanic (n = 168, 88.9%), while 10.1% identified as Hispanic (n = 19%), and two participants did not

report their ethnicity (*n* = 2, 1.1%). Regarding living arrangements, 46.6% reported living in a rental (*n* = 88), 33.9% in a fraternity or sorority house (*n* = 64), 14.8% in residence halls or dormitories (*n* = 28), and 4.8% in self- or family-owned housing (*n* = 9). Participants reported experiences of childhood physical abuse on a 10-item scale (M = 1.8, SD = 1.8, range = 0-10). Higher scores indicate greater exposure to physical abuse before age 18. 67.7% (*n* = 128) of the sample experienced at least one form of childhood physical abuse. 23.3% (*n* = 44) of the sample reported that they had experienced childhood sexual abuse.

Table 1: Sample Demographics

Variable		Total n (%)	Control n (%)	Treatment n (%)
Race	Asian/South Asian	23 (13.5%)	13 (15.3%)	10 (11.8%)
	Black/African American	2 (1.18%)	1 (1.18%)	1 (1.18%)
	Native American / American Indian / Alaska Native	2 (1.18%)	1 (1.18%)	1 (1.18%)
	White	118 (69.4%)	57 (67.1%)	61 (71.8%)
	Multi-racial	20 (11.8%)	10 (11.8%)	10 (11.8%)
	Other	1 (0.59%)	0 (0%)	1 (1.18%)
	I don't know	1 (0.59%)	1 (1.18%)	0 (0%)
	Missing	3 (1.76%)	2 (2.35%)	1 (1.18%)
Ethnicity	Non-Hispanic	151 (88.8%)	74 (87.1%)	77 (90.6%)
	Hispanic	17 (10.0%)	9 (10.6%)	8 (9.41%)
	Missing	2 (1.18%)	2 (2.35%)	0 (0%)
Living Situation	Own home	8 (4.71%)	5 (5.88%)	3 (3.53%)
	Rent/lease	83 (48.8%)	42 (49.4%)	41 (48.2%)
	Residence hall/dorm	20 (11.8%)	7 (8.24%)	13 (15.3%)
	Fraternity/sorority house	59 (34.7%)	31 (36.5%)	28 (32.9%)
Year in School	First year	41 (42.1%)	20 (23.5%)	21 (24.7%)
	Second year	36 (21.2%)	19 (22.4%)	17 (20.0%)
	Third year	42 (24.7%)	23 (27.1%)	19 (22.4%)
	Fourth year and above	51 (30.0%)	23 (27.1%)	28 (32.9%)
Employment	Yes	101 (59.4%)	54 (63.5%)	47 (55.3%)
	No	69 (40.6%)	31 (36.5%)	38 (44.7%)
Sorority Status	Yes	87 (51.2%)	45 (52.9%)	47 (55.3%)
	No	83 (48.8%)	40 (47.1%)	38 (44.7%)

2.2 Procedures

All procedures were approved by the university's Institutional Review Board. College women were randomly selected from a registrar to receive an email seeking participation in a study on emotions and behaviors. Interested individuals read an information statement about study procedures and completed a web-based screening survey to determine eligibility. Eligible participants were then directed to an online baseline survey in which they provided electronic consent and completed a battery of questionnaires including surveys assessing their alcohol use and psychological distress. They received a $30 gift card for completing the baseline survey.

Next, participants were randomized into either the intervention (n = 100) or assessment only control (n = 100) condition. For 14 consecutive days, individuals in both conditions received a link to a brief daily monitoring survey. After each daily survey, individuals in the intervention condition were presented with a 5–10-minute online skill module consisting of either an alcohol reduction strategy or emotion regulation skill (Stappenbeck et al., 2021). After the daily monitoring period, all participants were emailed follow-up surveys immediately post-treatment, at one month, and at six months post-treatment assessing their alcohol use. Individuals received a bonus $25 Amazon gift card if they completed at least seven of 14 daily monitoring surveys and all follow-up surveys. Participants received a $30 Amazon gift card for completing the follow-up survey immediately post-treatment and $40 Amazon gift cards for completing each of the 1- and 6-month follow-up surveys. The present study utilizes data from the baseline survey and the 14 daily diary surveys only.

2.2.1 Intervention Description

Individuals in the intervention condition received 14 brief (5-10-minute) online skill modules once each day immediately after completing a daily monitoring survey. Following the completion of each daily monitoring survey, those assigned to the intervention condition received 14 brief 5–10-minute skill modules, presented once per day in a web-based format that was mobile compatible. Each skill module included a 2- minute video providing an overview of the skill and interactive exercises to promote learning and increased personalization of skill content. Seven skill modules targeted improved regulatory abilities adapted from Dialectical and Behavior Therapy (Linehan, 1993, 2014). The focus of the adaptive skills were to help individuals prepare for distress, navigate crises, evaluate urges, and reduce suffering through acceptance-based strategies. Seven skill modules focused on alcohol reduction strategies utilizing cognitive behavioral strategies to decrease alcohol use by increasing awareness, managing unhelpful thoughts, modifying high-risk behaviors, anticipating triggers, and strengthening social support (Cronce & Larimer, 2011; Larimer & Cronce, 2007, Monti et al., 2002). Participants randomized to a control condition were only assessed. For an in-depth description of the intervention, including information on pilot testing and qualitative feedback, please see (Gulati et al., 2021).

2.3 Measures

2.3.1 *Baseline Measures*

Demographics. Demographics were reported at baseline, including age, sex, race/ethnicity, employment status, and sorority status which will be used to characterize the analyzed sample.

PTSD Symptom Severity. PTSD symptom severity was assessed via the PTSD Checklist for DSM-5 (PCL-5; Weather et al., 2013). The PCL-5 is a 20-item self-report measure that assess

past-month PTSD symptom severity based on DSM-5 diagnostic criteria for intrusion, avoidance, negative cognition and mood, and hyperarousal symptoms. Women reported their symptoms as related to their indicated index trauma. Higher scores indicate higher PTSD symptom severity with total scores ranging from 0-80, in which 31 is the criteria cut-off for suspected PTSD (Weathers et al., 2013). Participants completed the PCL-5 at baseline, immediate follow-up, 1-month, and 6-month after completion of the 2-week study period. As such, baseline PCL-5 was used to characterize the sample with a summed score to create a PTSD symptom severity score. A summed score, as opposed to an average, is typical for the PCL-5 because this can then indicate total symptom severity as opposed to average severity (Blevins et al., 2015). The PCL-5 demonstrated good internal consistency in the current sample ($\alpha = .83$)

Alcohol Use. The Daily Drinking Questionnaire (DDQ; Collins et al., 1985) was used to assess standard drinks consumed each day in a typical week during the past month and was administered at screening and all follow-up surveys. A sum score was created to reflect the total number of weekly drinks ("drinks per week"). A single item from the National Institute on Alcohol Abuse and Alcoholism Recommended Alcohol Questions (National Institute on Alcohol Abuse and Alcoholism, 2003) assessed HED frequency (i.e., four or more drinks within a two-hour period) in the past month on a scale of 0–30 times.

Lifetime Sexual Assault Severity. The Revised Sexual Experiences Scale (R-SES; Koss et al., 2007) was used to characterize participants' adolescent sexual assault severity using a severity score calculated following the approach outlined by Davis and colleagues (2014). The SES asks participants to indicate whether since the age of 14 they experienced unwanted sexual contact,

and/or attempted sexual penetration (oral, vaginal, or anal) or sexual penetration (oral, vaginal, or anal) as well as types of tactics used by the perpetrator (i.e., verbal coercion, physical force, intoxication). Participants then indicated the number of times they experienced each outcome type by each tactic (0 = *never*, 3 = *three or more times*). A continuous score representing severity of sexual assault history was calculated by multiplying a severity rank for each outcome/tactic combination (0 = *no history of sexual assault*, 1= *sexual contact by verbal coercion*, 2= *sexual contact by intoxication*, 3= *sexual contact by force*, 4 = *attempted or completed rape by verbal coercion*, 5 = *attempted or completed rape by intoxication*, 6 = *attempted or completed rape by physical force*) by the frequency with each combination was experience and summing the product. The resulting severity score had a possible range of 0 to 63.

Emotion Regulation Difficulties. The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) was used to characterize participants difficulties with regulating their emotions. The DERS is a 36-item self-report measure assessing multiple dimensions of emotion dysregulation, including nonacceptance of emotional responses, difficulties engaging in goal-directed behavior, impulse control difficulties, lack of emotional awareness, limited access to effective regulation strategies, and lack of emotional clarity. Participants rated how often each statement applied to them, with higher scores indicating greater emotion dysregulation. Items were summed to create a total score (range: 36–180). Participants completed the DERS at baseline. Internal consistency in the current sample was good ($\alpha = .86$).

2.3.2 *Daily Monitoring Surveys*

Negative Mood. Four questions assessed participants' current negative feelings and emotions in each daily survey. Participants indicated the extent to which they currently felt ashamed, sad,

stressed, angry, and afraid on 7-point scales (1 = *Not at all* to 7 = *Extremely*). Responses to these four items were averaged to create a current negative emotion score (α = .89).

Stress. One item assessed stress for the day prior (*"How stressful was yesterday's most stressful event?"*). Participants responded utilizing a 7-point scale (1 = *Not at all* to 7 = *Extremely*).

Alcohol Use. Participants were asked to indicate how many standard drinks (defined as 1.5 oz liquor, 12 oz beer, or 5 oz wine) they consumed the day prior from 0 to 25 or more drinks.

Drinking Motives. If the participant reported any drinking for that daily diary report, they were then asked to rate the degree to which they were motivated to drink for each of 3 coping reasons (Coping Drinking Motives; e.g., "*to forget your worries*") or 3 enhancement reasons (Enhancement Drinking Motives; e.g., "Because you wanted the pleasant feeling it gives you") on 7-point scales (1 = *Not at all* to 7 = *Extremely*). The coping drinking motives subscale demonstrated strong internal consistency (α = .87), while the enhancement drinking motives subscale demonstrated acceptable internal consistency (α = .66).

2.4 Analytic Approach

The analysis for this project utilized the R programming software version 4.3.1 for all analyses (R Core Team, 2023). Prior to analysis, lagged variables were created to ensure that the stress variable, which asked participants to report how stressful the most stressful event of the previous day was and how much alcohol was consumed the day prior, aligned with mood ratings and drinking motives that asked participants to report on current day experiences. This

adjustment improved alignment of reporting windows across variables such that all measures reflected experiences from the same day.

Because observations were nested within individuals, multilevel models with random intercepts were employed to allow participants to vary in their overall likelihood of drinking and the average number of drinks consumed when they drank (Kaysen et al., 2014). At level 1 (within-person), the data represents repeated measurements or daily variations within each individual over time whereas level 2 (between-person) represents stable individual differences or characteristics that vary between individuals including covariates. Analyses that ignore the nested or hierarchical structure of data within subjects can result in inflated type I error rates (Snijders & Bosker, 2012).

A multilevel mediation model was specified to test whether daily negative mood predicted alcohol quantity indirectly through coping-drinking motives (See figure 1). To comprehensively evaluate both between- and within-person effects, mood, and stress will be incorporated as person means and person-mean centered variables which can reduce the risk of a type II error (Lorah, 2022), with coping drinking motives as a mediator. As is appropriate with daily diary analyses of alcohol use, models accounted for weekly drinking patterns by including a weekend indicator (Huh et al., 2015). In addition, study day and treatment condition (0 = *Control*, 1 = *Treatment*) were also included. To account for the accumulation of emotion regulation skills and alcohol reduction strategies received over the assessment period by individuals assigned to the treatment condition.

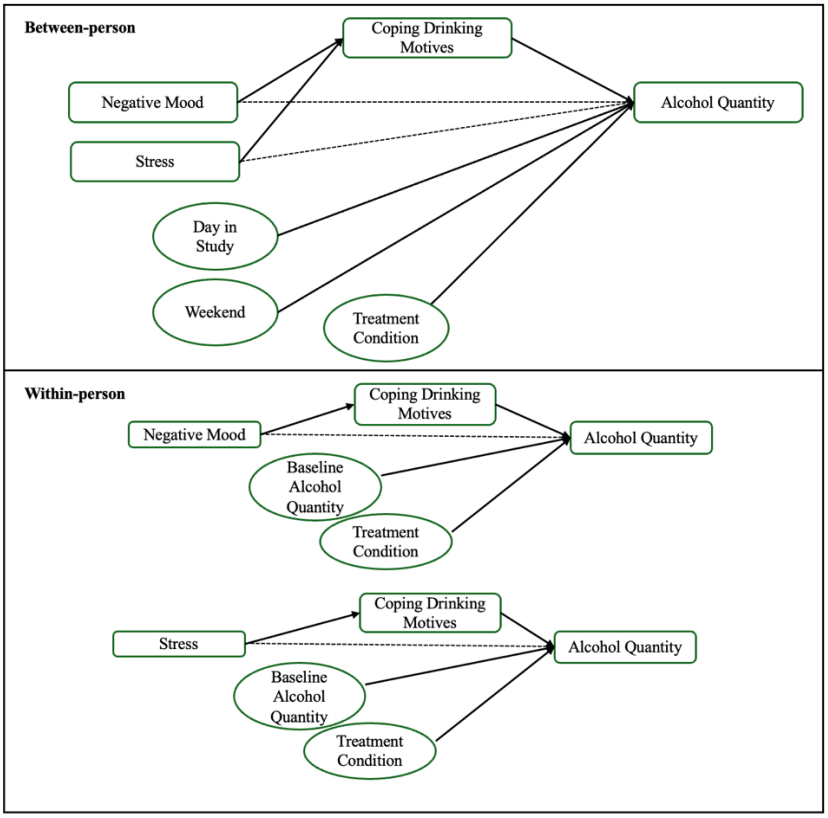

Figure 1: Coping Motives Model

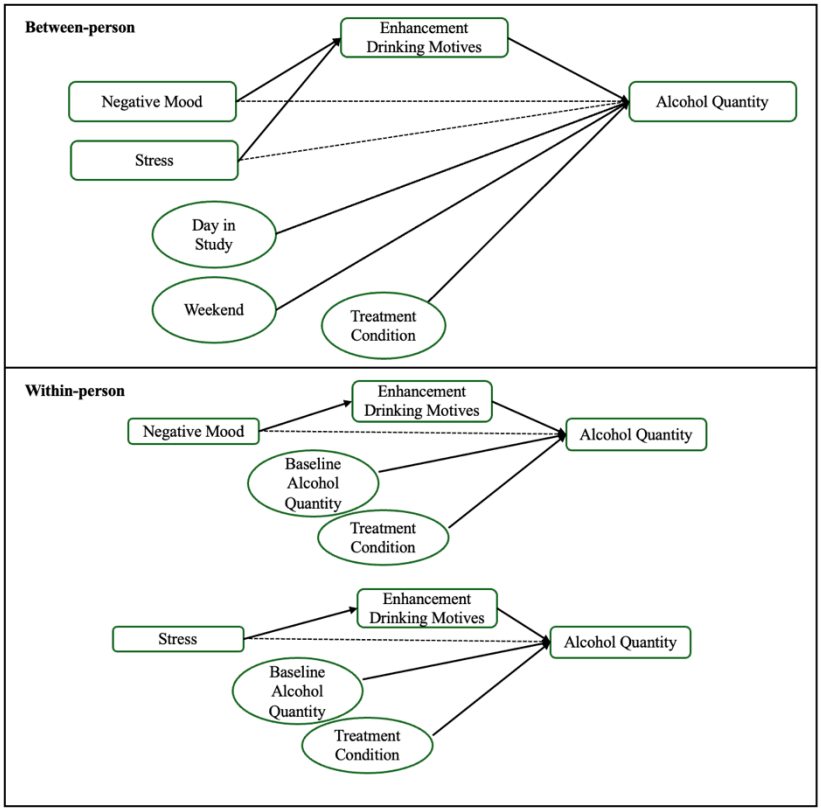

Figure 2: Enhancement Motives Model

To examine Aim 1 and Aim 2, Bayesian multilevel models were estimated via the R brms package (Bürkner, 2017). These models were designed to test both (a) the within- and between-person associations between negative mood, stress, and drinking motives (Aim 1; H1a-H1b), and (b) the mediating role of drinking motives in the relationship between negative mood and stress and alcohol consumption (Aim 2; H2a-H2c). Conceptual diagrams of the within- and between-person models for coping and enhancement motives are presented in Figure 1 and Figure 2, respectively. The mediator (coping motives) and the outcome variable (alcohol quantity) were modeled using a multivariate Gaussian family with identity links for both the means and standard deviation parameters, allowing the two equations to be estimated simultaneously and their residuals to correlate.

The drinking to cope equation tested the first portion of Aim 1 and Aim 2 by examining whether daily fluctuations in negative mood and stress predicted coping motives at both the within-person (H1a) and between-person levels (H1b). In addition, these associations formed the first-stage paths of the mediation models testing whether coping motives mediated the within-person associations of negative mood (H2a) and stress (H2b) with alcohol consumption. In this equation, negative mood and stress were included at both levels as predictors, along with weekend, study day, and treatment condition as covariates. Random intercepts and random slopes for within-person predictors were specified for each participant. The alcohol quantity equation tested the second portion of Aim 1 and the mediational hypotheses in Aim 2 by examining whether drinking to cope was associated with same-day alcohol consumption, controlling for negative mood, stress, baseline alcohol quantity, and covariates (H1a-H1b; H2a-H2b). Together, these equations allowed for evaluation of the indirect (mediated) effects of stress and negative mood on alcohol use through coping motives, as depicted in Figure 1. Parallel models were estimated substituting enhancement motives as the mediator to test the specificity of the self-medication pathway (Aim 2 H2c), with the corresponding model shown in Figure 2.

The No-U-Turn Sample (NUTS), a variant of the Hamiltonian Monte Carlo sampling method (Hoffman & Gelmann, 2014), was selected to estimate the posterior distribution because of the advantages for complex Bayesian models, such as hierarchical mediation models as the one employed in this study. NUTS adapts the path length and avoids inefficient random walks that plague traditional Hamiltonian Monte Carlo methods. This allows the model to efficiently explore high-dimensional posterior distributions and produce reliable parameter estimates even when models include multiple levels and correlated parameters. Convergence was evaluated

using the potential scale reduction factor (all <1.01), with all values, and effective sample sizes indicative of sufficient sampling efficiency.

To evaluate the within-person indirect effect of negative mood on alcohol quantity via drinking to cope, the product of the posterior samples for the path from negative mood to drinking to cope was computed (a-path) and the path from drinking to cope to alcohol quantity was also computed (b-path). The resulting distribution of the indirect effect (a x b) was summarized by its posterior mean and 95% credible interval. The models were visually assessed using marginal fits derived from the random-effects model with random intercepts, focusing on the conditional residuals of differential mood and coping intentions (Lorah, 2022).

2.5 Power Analysis

A post hoc power analysis was conducted to estimate the likelihood of detecting a medium effect size, which was selected following Cohen's conventions (Cohen, 1988, 1992). This power analysis utilized the R package "SIMR", which allows you to simulate data via a Monte Carlo simulation and estimate power for mixed-effects models (Green & MacLeod, 2016). This package was selected due to the flexibility in its ability to estimate the power for all commonly studied types of two-level effects (Arend & Schäfer, 2019). To simulate with known sample sizes, the following parameters are to be specified: level 1 and 2 direct effects, cross-level effect, random slop variance component, intraclass correlation coefficients, and slope-intercept correlation. The specifications for each of these parameters were selected based off conventional recommendations for such values (Arend & Schäfer, 2019). For Aims 1 and 2, there were 200 participants with approximately 3.5 drinking days per participant. A power analysis was conducted with 10,000 simulations (Arend & Schäfer, 2019) in which the Kenward Roger test estimated that the proposed multilevel model is powered at 100% to detect a medium effect size.

3 RESULTS

3.1 Descriptive Statistics

Baseline descriptive statistics for the total sample and by condition are presented in Table 3. On average, participants reported consuming 16.0 (*SD* = 8.7) drinks per week and engaging in heavy episodic drinking (HED) on 6.0 (*SD* = 4.0) occasions. Mean sexual assault severity was 28.2 (*SD* = 15.5), and participants reported moderate levels of emotion dysregulation (DERS: *M* = 96.8, *SD* = 24.9) and PTSD symptom severity (*M* = 21.6, *SD* = 18.3). In terms of analytic variables, a total of 170 women contributed 2,167 daily reports across the study period. On average, participants completed 9.69 (SD = 3.32) daily reports. An average of 3.5 observations per participant (n = 1,723 total observations) were classified as drinking days, which served as the level-1 units in the multilevel models. Participants showed meaningful day-to-day variability in study variables. Within-person fluctuations averaged 4.75 for negative mood, 1.51 for stress, 0.60 for coping motives, and 2.27 for alcohol quantity. Daily alcohol use was higher on weekends (*M* = 3.02, *SD* = 3.31) than on weekdays (*M* = 1.29, *SD* = 2.50). Descriptives of the daily diary variables used in the main analysis are presented in Table 2 and the correlation of these variables in Table 3.

Table 2: Descriptive and Analytic Variables Descriptives by Condition

Descriptive Variables	**Control M(SD)**	**Treatment M(SD)**	**Total M(SD)**
Drinks per Week	14.7(7.46)	13.4 (5.79)	16.0(8.66)
HED	5.4(3.8)	4.8 (3.6)	6.0(4.0)
Sexual Assault Severity	27.7(15.5)	27.2(15.5)	28.2(15.5)
DERS	95.2(24.7)	93.6(24.5)	96.8(24.9)
PTSD Severity	21.3(17.1)	20.9(15.9)	21.6(18.3)
Analytic Variables	**Control M(SD)**	**Treatment M(SD)**	**Total M(SD)**

Negative mood	12.40(6.80)	12.40(7.27)	12.42 (7.03)
Stress	3.50(1.68)	3.23(1.86)	3.38(1.77)
Coping motives	2.68(0.95)	2.59(0.99)	2.64(0.97)
Alcohol quantity	1.45(2.55)	1.59(2.69)	1.51(2.60)

Table 3: Study Variable Correlation Table

	Negative Mood	**Stress**	**Cope**	**Alcohol Quantity**
Negative Mood	1			
Stress	0.39*	1		
Coping Motives	0.37*	0.28*	1	
Alcohol Quantity	0.08*	0.03*	0.32*	1

Note. **p<.001*

3.2 Between-Person Effects and Random Effects

To address Aim 2, both between-person predictors and random effects were examined within the multilevel mediation model including both within- and between-person components. See Table 4 for full parameter estimates.

Table 4: Between-Person Effects Predicting Coping Motives and Alcohol Quantity

Predictor	**Outcome**	***b***	**95% CI (Lower, Upper)**
Negative Mood	Coping Motives	1.65	(0.63, 2.67)
Stress	Coping Motives	-0.26	(-1.12, 0.61)
Coping Motives	Alcohol Quantity	-0.04	(-0.06, -0.00)
Baseline Alcohol Quantity	Alcohol Quantity	0.19	(0.09, 0.30)
Negative Mood	Alcohol Quantity	-0.02	(-0.12, 0.07)
Stress	Alcohol Quantity	0.01	(-0.06, 0.08)

Note. *Predictors are all between-person variables.*

3.2.1 Between-Person Effects

At the between-person level, higher average negative mood was significantly associated with stronger average coping motives (b = 1.65, 95% CI [0.63, 2.67]). Average stress was not significantly associated with coping motives (b = -0.26, 95% CI [-1.12, 0.61]).

Examining alcohol quantity, higher average coping motives were significantly associated with lower average alcohol quantity (b = -0.04, 95% CI [-0.06, -0.00]). Average baseline alcohol quantity was positively associated with subsequent average daily alcohol quantity (b = 0.19, 95% CI [0.09, 0.30]). Between-person negative mood (b = -0.02, 95% CI [−0.12, 0.07]) and stress (b = 0.01, 95% CI [−0.06, 0.08]) were not significantly associated with alcohol quantity.

3.2.2 Random Effects

Random effects indicated substantial heterogeneity in key within-person associations across participants. For the association between within-person negative mood and coping motives, the random-slope standard deviation was 2.44 (95% CI [1.36, 3.47]). For the association between coping motives and alcohol quantity, the slope standard deviation was 0.09 (95% CI [0.07, 0.10]).

Random slopes for within-person stress predicting coping motives also varied across participants, with a standard deviation of 0.60 (95% CI [0.03, 1.36]). Random intercepts for coping motives had a standard deviation of 3.67 (95% CI [2.89, 4.49]), and random intercepts for alcohol quantity had a standard deviation of 0.03 (95% CI [0.00, 0.08].

3.3 Within-Person Mediation of Negative Mood and Stress

3.3.1 Coping Motives

Daily deviations in negative mood from a person's mean were positively associated with coping motives (a-path: $b = 1.21$, 95% CrI [0.35, 2.09]). Coping motives were positively associated with same-day alcohol quantity (b-path: $b = 0.19$, 95% CrI [0.16, 0.22]). The direct association between negative mood and alcohol quantity controlling for coping motives was also positive (c′-path: $b = 0.11$, 95% CrI [0.03, 0.19]). The estimated indirect effect of within-person negative mood on alcohol quantity through coping motives supported a significant mediation effect (**ab:** $b = 0.23$, 95% CrI [0.07, 0.40]).

Daily deviations in stress from a person's mean were not reliably associated with coping motives (a-path: $b = 0.30$, 95% CrI [-0.10, 0.70]). Coping motives were positively associated with daily alcohol quantity (b-path: $b = 0.19$, 95% CrI [0.16, 0.22]). The direct association between stress and alcohol quantity controlling for coping motives was small and negative (c′-path: $b = -0.04$, 95% CrI [-0.08, -0.001)]). The estimated indirect effect of within-person stress on alcohol quantity through coping motives did not support a significant mediation (ab*:* $b = 0.06$, 95% CrI [-0.02, 0.13]), and the total effect was not significant (b = 0.02, 95% CrI [-0.06, 0.10]). Full model estimates are presented in Table 5, and Figure 3 visualizes the coping medication pathways.

Table 5: Bayesian Multilevel Mediation Model Predicting Coping Drinking Motives and Alcohol Quantity

	Coping Drinking Motives		**Alcohol Quantity**	
Predictor	***b***	**95% CrI**	***b***	**95% CrI**
Intercept	3.91	[-1.14, 9.02]	-0.24	[-0.72, 0.24]
Within-person predictors				

Negative mood	1.21*	[0.35, 2.09]	0.11*	[0.03, 0.19]
Stress	0.3	[-0.10, 0.70]	-0.04	[-0.08, -0.00]
Between-person predictors				
Negative mood	1.65*	[0.63, 2.67]	-0.02	[-0.12, 0.07]
Stress	-0.26	[-1.12, 0.61]	0.01	[-0.06, 0.08]
Coping drinking motive	—	—	-0.04	[-0.06, -0.01]
Alcohol quantity	—	—	0.19	[0.09, 0.30]
Between-person covariates				
Weekend	7.29*	[5.66, 8.90]	0.26*	[0.01, 0.51]
Study day	-0.05	[-0.18, 0.07]	0.01	[-0.00, 0.02]
Treatment dose	-0.17	[-0.52, 0.18]	-0.01	[-0.04, 0.03]
Treatment condition	1.12	[-2.38, 4.74]	0.08	[-0.25, 0.42]

Note. * indicates that the 95% credible interval excludes zero.

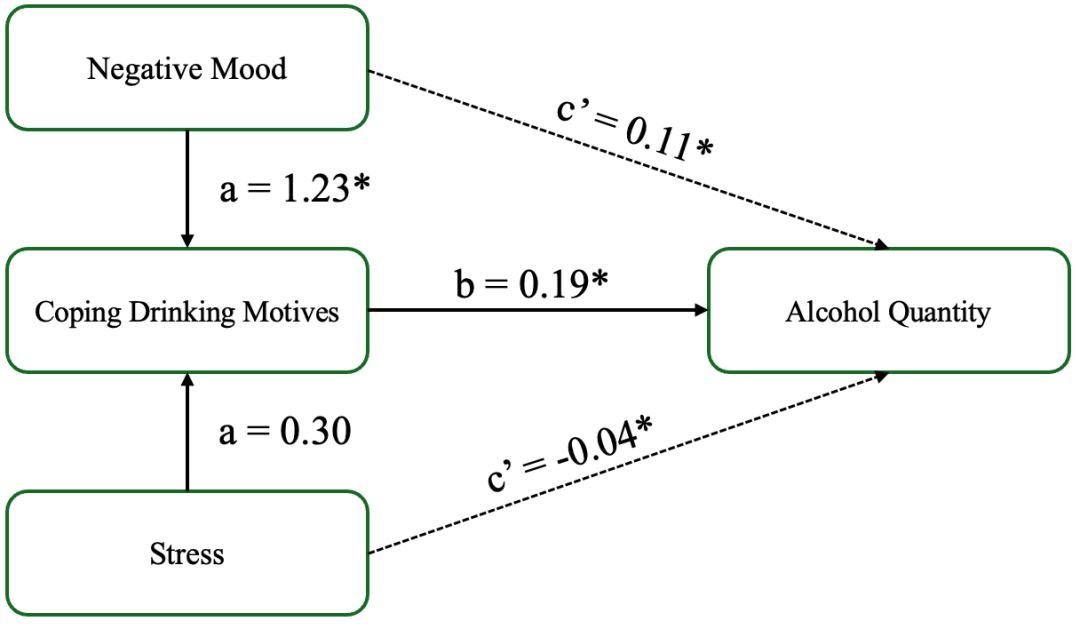

Figure 3: Coping Mediation Pathways

3.3.2 Enhancement Motives

Daily deviations in negative mood from a person's mean were not associated with enhancement motives (a-path: b = 0.01, 95% CrI [-0.02, 0.03]). Within-person increases in

enhancement motives were positively associated with greater same-day alcohol quantity (b-path: b = 0.92, 95% CrI [0.19, 1.59]). The direct association between negative mood and alcohol quantity controlling for enhancement motives remained significant (c′-path: b = 0.08, 95% CrI [0.04, 0.11]). The estimated indirect effect of within-person negative mood on alcohol quantity through enhancement motives was not supported (ab ≈ 0.01, 95% CrI spanning zero), and the total effect remained positive. See Figure 5 for a visualization of these pathways.

Daily deviations in stress from a person's mean were not reliably associated with enhancement motives (a-path: b = -0.06, 95% CrI [-0.14, 0.03]). Enhancement motives were positively associated with same-day alcohol quantity (b-path: b = 0.92, 95% CrI [0.19, 1.59]). The direct association between stress and alcohol quantity controlling for enhancement motives was not significant (c′-path: b = 0.07, 95% CrI [-0.05, 0.20]). The estimated indirect effect of within-person stress on alcohol quantity through enhancement motives was not supported (ab ≈ -0.05, 95% CrI spanning zero), and the total effect was not significant. Full model estimates are presented in Table 6, and Figure 4 visualizes the enhancement medication pathways.

Table 6: Bayesian Multilevel Mediation Model Predicting Enhancement Drinking Motives and Alcohol Quantity

	Enhancement Drinking Motives		**Alcohol Quantity**	
Predictor	***b***	**95% CrI**	***b***	**95% CrI**
Intercept	4.26	[3.27, 5.23]	1.64	[-0.34, 3.70]
Within-person predictors				
Negative mood	0.01	[-0.02, 0.03]	0.08*	[0.04, 0.11]
Stress	-0.06	[-0.14, 0.03]	0.07	[-0.05, 0.20]
Between-person predictors				
Negative mood	0	[-0.04, 0.03]	-0.01	[-0.06, 0.04]
Stress	0.12	[-0.07, 0.32]	-0.08	[-0.35, 0.18]
Coping drinking motive	—	—	-0.46	[-0.94, 0.03]
Alcohol quantity	—	—	0.94*	[0.74, 1.15]
Between-person covariates				

Weekend	0.35*	[0.11, 0.59]	0.66*	[0.19, 1.14]
Study day	-0.03	[-0.05, -0.00]	0.03	[-0.02, 0.07]
Treatment dose	0.01	[-0.06, 0.08]	0.11*	[0.01, 0.20]
Treatment condition	-0.34	[-1.03, 0.35]	-0.92	[-1.86, 0.03]

Note. * indicates that the 95% credible interval excludes zero.

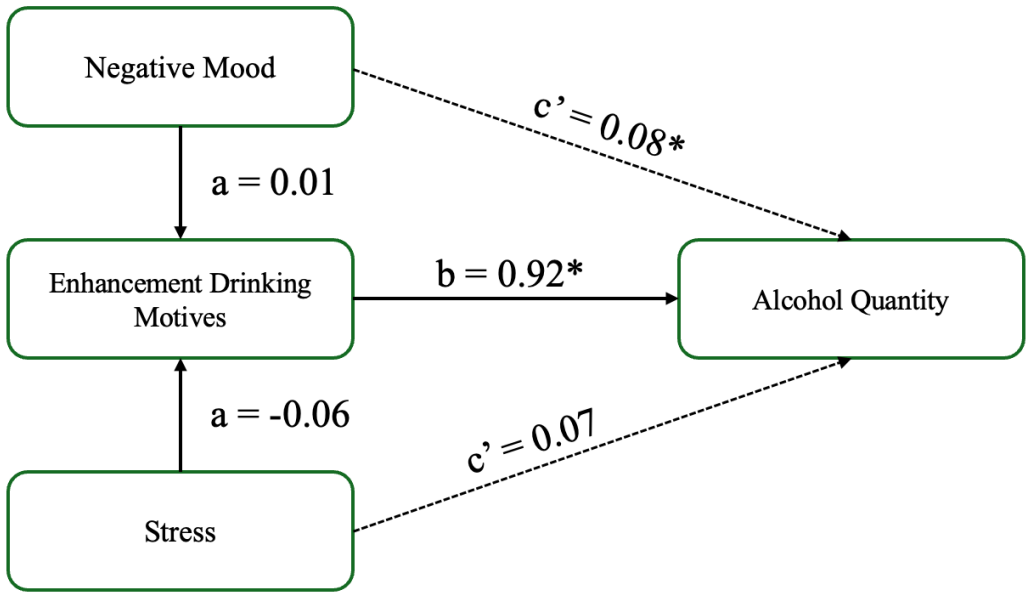

Figure 4: Enhancement Mediation Pathways

4 DISCUSSION

This study investigated the self-medication hypothesis by examining both within- and between-person associations among mood, stress, coping drinking motives, and alcohol consumption in a high-risk sample of heavy-drinking college women with sexual assault histories. Several key findings emerged. First, Aim 1 highlights between-person effects such that participants with higher average levels of negative mood and stress also reported stronger coping motives for drinking. However, between-person differences in negative mood and stress did not significantly predict differences in the amount of alcohol consumed. On days when participants

reported higher negative mood than their personal average, they were more likely to endorse stronger coping drinking motives. In turn, higher coping motives predicted greater alcohol quantity consumed on those same days, supporting a daily concordance between mood, motives, and drinking. Together, results suggest that within-person fluctuations are more predictive of alcohol use quantity than trait-like differences across individuals. This extends previous research that suggests within-person variation (daily deviation) is a better predictor of alcohol use than between-person (average) differences (Mohr et al., 2015).

Aim 2 was partially supported. Although coping motives did not mediate the association between stress and alcohol use quantity, there was a significant within-person mediation effect whereby negative mood predicted greater alcohol use indirectly through elevated coping motives. Moreover, although enhancement motives was positively associated with alcohol use quantity, neither stress nor negative mood were significantly associated with enhancement motives and enhancement motives did not mediate the associations between either negative mood or stress and alcohol use quantity. These findings are consistent with previous research highlighting coping motives as proximal predictors of drinking (Kuntsche et al., 2005) and further underscores coping motives as a key proximal mechanism linking negative mood and alcohol consumption. Importantly, findings align with motivational models (Cooper, 1994) differentiating coping and enhancement motives, suggesting that negative affect–driven drinking is uniquely explained by coping motives rather than enhancement motives as is consistent with a self-medication (negative reinforcement) process rather than drinking for positive reinforcement.

These findings provide support for the self-medication hypothesis (Khantzian, 1997), particularly within an event-level framework. The results suggest that day-to-day changes in negative mood is closely related to alcohol use through its influence on coping-related motives.

This extends prior research that has primarily relied on cross-sectional or between-person designs by demonstrating that fluctuations relative to one's average negative mood are associated with coping-motivated drinking and higher same-day alcohol use, even among individuals already characterized as heavy drinkers. The findings highlight the importance of momentary motives: how mood, motives, and drinking co-occur on a given day. While individuals with generally higher negative mood endorsed more coping motives, only daily-level increases in negative mood relative to own's own average translated to greater drinking. This underscores the importance of nuanced, event-level examination in emotion-motivated drinking and cautions against relying solely on between-person associations.

Although both mood and stress were examined, only negative mood – and not stress – was associated with same-day drinking via coping motives. This may suggest that negative mood states are more proximal or psychologically salient triggers for alcohol use than stress. Indeed, although stress and negative mood are often interrelated and sometimes experimentally indistinguishable (Hogarth et al., 2018), stress is most strongly related to alcohol use when it elicits negative mood or in individuals with elevated internalizing symptoms or coping motives (Field & Powell, 2007; Field & Quigley, 2009; Sinha et al., 2009). These findings suggest that stress may not be sufficient on its own to motivate drinking rather, drinking may be more strongly linked to the negative emotional distress that stressful experiences evoke. Thus, it is also possible that people may differentiate between generalized stress and mood-based distress in meaningful ways. Further, the coping responses used for chronic stressors may differ from those used in response to discrete negative emotional experiences that are more proximal to drinking decisions. Additionally, it may be that the stress measure did not fully capture the range of stressors most relevant to coping-motivated drinking, particularly acute or trauma-relevant

stressors that are more likely to elicit emotional distress and prompt alcohol use. As a result, the measure may have been less sensitive to the specific types of stress most likely to activate the self-medication process in this sample. Further, the null within-person mediation effect may also reflect limited power to detect smaller effects. Further, it is possible that the specific assessment of stress used in this study did not fully capture the types of acute, trauma-relevant stressors most likely to trigger coping-motivated drinking.

Analytically, the wide confidence intervals around the stress coefficients could suggest insufficient power to detect smaller or more complex effects of stress, such as lagged or non-linear relationships. Because stress and negative mood are highly correlated, it could be that stress alone would have a significant effect, but when considering both variables in a model simultaneously, negative mood emerges as the stronger predictor. Beyond affective predictors, weekend drinking was elevated as expected, likely reflecting social patterns of alcohol consumption. Additionally, effects of treatment condition and treatment dose indicated that the intervention influenced drinking behavior over time, reinforcing the importance of accounting for intervention exposure in longitudinal alcohol research.

This study contributes to the growing body of research supporting the self-medication hypothesis in trauma-exposed populations by replicating and extending prior event-level findings in keyways. First, although previous work (Stappenbeck et al., 2023a) has established that within-person increases in negative mood predicted greater coping motives, which in turn predicted higher alcohol use, this study offers a contextual replication in a distinct sample: heavy-drinking college women, in which the full sample had sexual assault histories, participating in a randomized treatment trial. Replication in different yet high-risk samples enhance the generalizability of these mechanisms and contributes to the robustness of the self-

medication framework. Second, the inclusion of both treatment and control conditions in the analytic models offer a unique strength. This design allows for examination of how self-medication processes operate in the real world, where individuals may vary in their exposure to intervention strategies. Controlling for treatment condition and accumulated treatment dose helps clarify whether mod-related drinking persists even when emotion regulation or alcohol reduction strategies have been introduced. This increases the ecological and translational validity of the findings and informs intervention design. Third, while the use of Bayesian multilevel mediation modeling is not fully novel in this area, the present study benefits from robust estimation techniques that account for uncertainty and individual variability. This modeling approach also distinguishes within- and between-person effects, allowing us to examine the self-medication pathway as driven by state-level fluctuations in negative mood rather than stable, trait-level differences. Finally, this study expands prior work by incorporating daily stress alongside negative mood, allowing for a more nuanced understanding of which affective states drive coping-motivated drinking. While negative mood emerged as a stronger proximal predictor, the inclusion of stress highlights the complexity of emotional processes and raises important questions for future research. Together, these contributions offer both confirmatory and clarifying insights, reinforcing the value of examining emotion-drinking links at the daily level while extending the conversation toward real-world intervention contexts.

4.1 Implications

Findings from this study have several important clinical and public health implications. First, the findings highlight the potential of real-time intervention opportunities. Because negative mood predicted increases in coping motives which, in turn, predicted drinking, ecological momentary interventions that deliver just-in-time coping skills in response to increases in

negative mood may be particularly effective at reducing mood-driven drinking episodes. Intervening in those moments of elevated distress, rather than relying on retrospective strategies, may be more effective in interrupting the mood, motive, and drinking sequence examined here.

Additionally, interventions may benefit from identifying individuals with strong mood-drinking links and specifically targeting them with strategies to disrupt the motive-consumption pathway. For example, assessment could flag individuals who drinking is more strongly driven by emotional states and then tailor the treatment modules to focus more heavily on negative reinforcement processes. This may have the potential of early prevention among high-risk populations, such as women with sexual assault histories. Indeed, routine screening for coping drinking motives in treatment settings could help identify individuals at risk of using alcohol to manage negative mood, even among those not presenting with severe drinking levels.

Finally, from a public health perspective, these findings highlight the importance of multi-level prevention and intervention strategies that address the emotional contexts that drive alcohol use. Campus-wide alcohol prevention efforts often focus primarily on reducing overall consumption or correcting normative misperceptions; however, the present results suggest that addressing underlying negative mood and trauma-related distress may be equally critical. Integrating trauma-informed approaches into campus prevention programming, expanding access to mental health services, and promoting adaptive emotion regulation skills may help reduce reliance on alcohol as a coping strategy. By addressing the emotional antecedents of alcohol use, prevention and intervention efforts may reduce reliance on alcohol use as a coping strategy and mitigate downstream alcohol-related harms in this high-risk population.

4.2 Strengths and Limitations

This study has several notable strengths. First, the use of a multilevel analytic framework allowed for a clear differentiation between within-person processes (how fluctuations in stress and mood predict daily changes in coping motives and drinking) and between-person differences (how individuals' average levels of these variables relate to one another). This is a critical advantage when testing hypotheses rooted in dynamic models of alcohol use, such as the self-medication hypothesis. The daily diary design further enhanced ecological validity by capturing participants' experiences in their natural environments and reducing reliance on long-term retrospective reports, which are particularly susceptible to memory distortion and are less likely to be reported (Brennan et al., 2006; Wagenaar, 1986). Additionally, the use of robust Bayesian estimation provided credible interval–based inference, better quantified uncertainty around effect estimates, and offered improved stability for small-sample multilevel models compared to traditional frequentist approaches.

Despite these strengths, several limitations warrant consideration. A primary limitation is the use of a single daily assessment, as opposed to methods that employ multiple surveys a day such as ecological momentary assessment, which restricts the ability to determine the precise temporal ordering of emotional states, coping motives, and alcohol consumption within a given day. This limits inferences about how quickly these processes unfold within a day. Importantly, although variables were aligned to reflect the same reporting window, the present design captures daily concordance rather than true temporal sequencing, limiting the ability to determine whether changes in mood precede coping motives or alcohol use within a given day. Additionally, as stress was measured via a single item, the reliability and dimensionality of this construct may be limited. The use of self-report measures introduces the possibility of recall bias and social desirability bias, especially for sensitive constructs such as drinking motives or trauma-related

negative affect. Generalizability is another limitation: although the sample reflects the demographics of the population from which it was recruited, the homogeneous and college-based sample may not represent broader and more diverse populations of trauma-exposed women. Additionally, unmeasured confounders, such as peer drinking behavior, social situational factors, or availability of alcohol, may influence both mood and drinking patterns, potentially biasing associations. The study also did not assess coping motives on non-drinking days**,** making it difficult to determine whether high coping motives sometimes reflect a desire to drink that is not acted upon (e.g., due to lack of access or external constraints) versus an actual deterrence of drinking. Finally, the relatively small sample size may have reduced statistical power to detect modest associations or between-person effects.

4.3 Future Directions

Several promising lines of inquiry could help extend and clarify the mechanisms identified in this study. First, implementing experience sampling or ecological momentary assessment with multiple assessments per day would allow researchers to model the temporal sequencing of mood, coping motives, and alcohol use with far greater precision. Such designs could test whether coping motives arise before or after mood shifts, how long motives persist, and whether they predict imminent drinking behavior. Future work may also benefit from examining emotion regulation strategies alongside drinking motives to determine whether adaptive regulatory skills buffer the mood–drinking association or interrupt the motive pathway.

Another important direction could be assessing coping motives in the absence of drinking, which would clarify whether high motives reflect an intention to drink that is overridden by contextual barriers, competing motivations, or protective factors. This would

provide insight into when coping motives lead to actual drinking behavior versus when they remain unacted upon.

Future research may also explore individual difference moderators, such as trauma severity, impulsivity, drinking identity, emotion regulation capacity, or social support, which could influence the strength or direction of within-person associations. Incorporating lagged or intensive longitudinal models across longer study periods would help determine whether stress or negative mood exerts delayed effects on drinking across several days or weeks, and whether patterns accumulate over time.

Finally, replication in larger and more diverse samples is critical. Including more racially and ethnically diverse participants, non-college populations, and individuals with broader ranges of drinking behavior and trauma histories will improve external validity and support the development of equitable intervention strategies. These expansions will help determine whether the within-person processes observed here generalize across diverse social contexts and risk profiles.

4.4 Conclusion

This study provides novel evidence that negative mood contributes to drinking via increased coping motives among women with sexual assault histories, offering support for the self-medication hypothesis in a real-world, event-level context. The findings underscore the importance of identifying when alcohol is used to cope and point toward targeted, moment-sensitive intervention strategies. Ultimately, this work highlights the utility of within-person frameworks to understand and intervene in maladaptive coping behaviors in high-risk populations.

REFERENCES

Abbey, A., Parkhill, M. R., & Koss, M. P. (2005). The effects of frame of reference on responses to questions about sexual assault victimization and perpetration. *Psychology of Women Quarterly*, *29*(4), 364-373.

Amar, A. F., & Gennaro, S. (2005). Dating violence in college women: Associated physical injury, healthcare usage, and mental health symptoms. Nursing Research, 54(4), 235-242.

American Association of University Professors. (2012). *Campus sexual assault: Suggested policies and procedures.* https://www.aaup.org/file/Sexual_Assault_Policies.pdf

Arend, M. G., & Schäfer, T. (2019). Statistical power in two-level models: A tutorial based on Monte Carlo simulation. *Psychological methods*, *24*(1), 1.

Armstrong, E., Hamilton, L., & Sweeney, B. (2006). Sexual Assault on Campus: a Multilevel, Integrative Approach to Party Rape. *Social Problems*, 53, 483-499.

Badour, C. L., Blonigen, D. M., Boden, M. T., Feldner, M. T., & Bonn-Miller, M. O. (2012). A longitudinal test of the bi-directional relations between avoidance coping and PTSD severity during and after PTSD treatment. *Behaviour Research and Therapy*, *50*(10), 610-616. https://doi.org/10.1016/j.brat.2012.06.006

Baker, T. B., Piper, M. E., McCarthy, D. E., Majeskie, M. R., & Fiore,M. C. (2004). Addiction motivation reformulated: An affective processing model of negative reinforcement. *Psychological Review*, 111, 33–51.

Basile, K. C., & Smith, S. G. (2011). Sexual violence victimization of women: Prevalence, characteristics, and the role of public health and prevention. *American Journal of Lifestyle Medicine*, *5*(5), 407-417. DOI: 10.1177/1559827611409512

Bedard-Gilligan, M., Lehinger, E., Cornell-Maier, S., Holloway, A., & Zoellner, L. (2022). Effects of cannabis on PTSD recovery: review of the literature and clinical insights. *Current addiction reports*, *9*(3), 203-216.

Bedard-Gilligan M., Kaysen D., Desai S., Lee C. M. (2011) Alcohol-involved assault: Associations with posttrauma alcohol use, consequences, and expectancies. *Addictive Behaviors.* 36, 1076–1082. doi:10.1016/j.addbeh.2011.07.001.

Bird, E. R., Stappenbeck, C. A., Blayney, J., Kaysen, D., & George, W. H. (2022). Examination of sex-related distress and self-medication drinking model in US college women. *The Journal of Sex Research*, *59*(9), 1192-1200. https://doi.org/10.1080/00224499.2022.2044444

Blevins, C. A., Weathers, F. W., Davis, M. T., Witte, T. K., & Domino, J. L. (2015). The posttraumatic stress disorder checklist for DSM-5 (PCL-5): Development and initial psychometric evaluation. *Journal of traumatic stress*, *28*(6), 489-498. **https://doi.org/10.1002/jts.22059**

Blume, A. W., Schmaling, K. B., & Marlatt, G. A. (2000). Revisiting the self-medication hypothesis from a behavioral perspective. *Cognitive and Behavioral Practice*, *7*(4), 379-384. https://doi.org/10.1016/S1077-7229(00)80048-6

Brennan, A. M., Stewart, H. A., Jamhour, N., Businelle, M. S., & Gouvier, W. D. (2006). An examination of the retrospective recall of psychological distress. *Journal of forensic neuropsychology*, *4*(4), 99-110. https://doi.org/10.1300/J151v04n04_06

Campbell, R. (2008). The psychological impact of rape victims' experiences with the legal, medical and mental health systems. *American Psychologist*, *63*, 702–717.

Campbell R., Dworkin E., & Cabral G. (2009). An ecological model of the impact of sexual assault on women's mental health. *Trauma, Violence, and Abuse*, 10, 225–246.

Campbell, R., Wasco, S. M., Ahrens, C. E., Sefl, T., & Barnes, H. E. (2001). Preventing the "second rape" rape survivors' experiences with community service providers. *Journal of Interpersonal Violence*, **16**, 1239–1259. doi:10.1177/088626001016012002

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, NJ: Erlbaum.

Cohen, J. (1992). A power primer. Psychological Bulletin, 112, 155–159. http://dx.doi.org/10.1037/0033-2909.112.1.155

Collins, R. L., Parks, G. A., & Marlatt, G. A. (1985). Social determinants of alcohol consumption: the effects of social interaction and model status on the self-administration of alcohol. *Journal of consulting and clinical psychology*, *53*(2), 189.

Cranney S. (2015). The relationship between sexual victimization and year in school in US colleges: Investigating the parameters of the "red zone." *Journal of Interpersonal Violence*, 30, 3133–3145.

Cronce, J. M., & Larimer, M. E. (2011). Individual-focused approaches to the prevention of college student drinking. *Alcohol Research & Health, 34*(2), 210–221.

Davis, K. C., Gilmore, A. K., Stappenbeck, C. A., Balsan, M. J., George, W. H., & Norris, J. (2014). How to score the Sexual Experiences Survey? A comparison of nine methods. *Psychology of violence*, *4*(4), 445.

Davis, K. C., Stoner, S. A., Norris, J., George, W. H., & Masters, N. T. (2009). Women's awareness of and discomfort with sexual assault cues: Effects of alcohol consumption

and relationship type. *Violence Against Women*, *15*(9), 1106-1125. DOI: 10.1177/1077801209340759

DeLoveh, H. L., & Cattaneo, L. B. (2017). Deciding where to turn: A qualitative investigation of college students' helpseeking decisions after sexual assault. *American journal of community psychology*, *59*(1-2), 65-79. **https://doi.org/10.1002/ajcp.12125**

Department of Justice, Office of Justice Programs, Bureau of Justice Statistics. (2014). *Rape and sexual victimization among college-aged females, 1995–2013.* https://www.bjs.gov/

DiMauro, J., & Renshaw, K. D. (2019). PTSD and relationship satisfaction in female survivors of sexual assault. Psychological trauma: theory, research, practice, and policy, 11(5), 534-541. https://doi.org/10.1037/tra0000391

Dimeff, L. A., & McNeely, M. (2000). Computer-enhanced primary care practitioner advice for high-risk college drinkers in a student primary health-care setting. *Cognitive and Behavioral Practice, 7*(1), 82–100. https://doi.org/10.1016/S1077-7229(00)80010-3

Dworkin, E. R., Jaffe, A. E., Fitzpatrick, S., Rhew, I. C., & Kaysen, D. (2021). Daily relationships between posttraumatic stress symptoms, drinking motives, and alcohol consumption in trauma-exposed sexual minority women. *Psychology of Addictive Behaviors*, *35*(1), 3-15. DOI: 10.1037/adb0000680

Dworkin E. R., Menon S. V., Bystrynski J., Allen N. E. (2017). Sexual assault victimization and psychopathology: A review and meta-analysis. *Clinical Psychology Review*, 56, 65–81.

Ellis, A. (2008). Cognitive restructuring of the disputing of irrational beliefs. In W. T. O'Donohue & J. E. Fisher (Eds.), Cognitive behavior therapy: *Applying empirically supported techniques in your practice* (2nd ed., pp. 91–95). Hoboken, NJ: Wiley

Fisher, B. S., Daigle, L. E., Cullen, F. T., & Turner, M. G. (2003). Reporting sexual victimization to the police and others: Results from a national-level study of college women. *Criminal justice and behavior*, *30*(1), 6-38.

Flack W. F., Hansen B. E., Hopper A. B., Bryant L. A., Lang K. W., Massa A. A., Whalen J. E. (2016). Some types of hookups may be riskier than others for campus sexual assault. *Psychological Trauma: Theory, Research, Practice, and Policy*, 8, 413–420.

Garcia-Esteve, L., Torres-Gimenez, A., Canto, M., Roca-Lecumberri, A., Roda, E., Velasco, E. R., Echevarría, T., Andero, R., & Subirà, S. (2021). Prevalence and risk factors for acute stress disorder in female victims of sexual assault. *Psychiatry Research*, *306*, 114240. https://doi.org/10.1016/j.psychres.2021.114240

Gilmore, A. K., Lewis, M. A., & George, W. H. (2015). A randomized controlled trial targeting alcohol use and sexual assault risk among college women at high risk for victimization. Behaviour Research and Therapy, 74, 38-49. https://doi.org/10.1016/j.brat.2015.08.007

Green P. & MacLeod C.J. (2016). "simr: An R package for power analysis of generalised linear mixed models by simulation." *Methods in Ecology and Evolution*, **7**(4), 493–498. doi:10.1111/2041-210X.12504, https://CRAN.R-project.org/package=simr.

Griffin M. J., Read J. P. Prospective effects of method of coercion in sexual victimization across the first college year. *Journal of Interpersonal Violence.* 2012;27:2503–2524. doi:10.1177/0886260511433518.

Guggisberg, M. (2012). Sexual violence victimisation and subsequent problematic alcohol use: Examining the self-medication hypothesis. *International Journal of Arts & Sciences*, *5*(6), 723-736.

Gulati, N. K., Blayney, J. A., Jaffe, A. E., Kaysen, D., & Stappenbeck, C. A. (2021). A formative evaluation of a web-based intervention for women with a sexual assault history and heavy alcohol use. *Psychological Trauma: Theory, Research, Practice, and Policy, 13*(8), 825-834.

Gutner, C. A., Rizvi, S. L., Monson, C. M., & Resick, P. A. (2006). Changes in coping strategies, relationship to the perpetrator, and posttraumatic distress in female crime victims. Journal of Traumatic Stress, 19, 813–823.

Hall, D. H., & Queener, J. E. (2007). Self-medication hypothesis of substance use: Testing Khantzian's updated theory. *Journal of Psychoactive Drugs*, *39*(2), 151-158.

Hammett, J. F., Chen, W., Stappenbeck, C. A., & Davis, K. C. (2025). Alcohol expectancies for sexual enhancement, event-level alcohol use, and likelihood of sexual aggression perpetration: A timeline followback approach. *The Journal of Sex Research*, *62*(2), 224-231. https://doi.org/10.1080/00224499.2024.2332421

Harned, M. S. (2005). Understanding women's labeling of unwanted sexual experiences with dating partners: A qualitative analysis. *Violence against women*, *11*(3), 374-413.

Hawn, S. E., Cusack, S. E., & Amstadter, A. B. (2020). A systematic review of the self-medication hypothesis in the context of posttraumatic stress disorder and comorbid problematic alcohol use. *Journal of traumatic stress*, *33*(5), 699-708.

Huh, D., Kaysen, D. L., & Atkins, D. C. (2015). Modeling cyclical patterns in daily college drinking data with many zeroes. *Multivariate Behavioral Research*, *50*(2), 184-196.

Jackman, S., Tahk, A., Zeileis, A., Maimone, C., Fearon, J., & Meers, Z. (2024). *pscl: Political Science Computational Laboratory* (Version 1.5.9) [R package]. CRAN. https://CRAN.R-project.org/package=pscl

Kaysen, D., Atkins, D. C., Simpson, T. L., Stappenbeck, C. A., Blayney, J. A., Lee, C. M., & Larimer, M. E. (2014). Proximal relationships between PTSD symptoms and drinking among female college students: results from a daily monitoring study. *Psychology of Addictive Behaviors*, *28*(1), 62-73. https://doi.org/10.1037/a0033588

Kaysen, D., Neighbors, C., Martell, J., Fossos, N., & Larimer, M. E. (2006). Incapacitated rape and alcohol use: A prospective analysis. *Addictive behaviors*, *31*(10), 1820-1832. DOI: 10.1016/j.addbeh.2005.12.025

Kearns, M. C., Ressler, K. J., Zatzick, D., & Rothbaum, B. O. (2012). Early interventions for PTSD: A review. *Depression and Anxiety*, **29**, 833–842. DOI:10.1002/da.21997

Keyes, K. M., Hatzenbuehler, M. L., Grant, B. F., & Hasin, D. S. (2012). Stress and alcohol: epidemiologic evidence. *Alcohol research: current reviews*, *34*(4), 391.

Khantzian, E. J. (1997). The self-medication hypothesis of substance use disorders: A reconsideration and recent applications. *Harvard Review of Psychiatry*, *4*(5), 231-244.

Khantzian, E. J. (2003). The self-medication hypothesis revisited: The dually diagnosed patient. Primary Psychiatry, 10, 47-54.

Kilimnik, C. D., García-Ramírez, G., Salamanca, N. K., Mazzone, G. M., Mullican, K. N., Davis, K. C., Orchowski, L. M., Leone, R. M., Kaysen, D., & Gilmore, A. K. (2023). Associations among sexual assault, posttraumatic stress, drinking to cope with anxiety, and alcohol use based on gender identity and sexual orientation. *Alcohol: Clinical and Experimental Research*, *47*(11), 2169-2183. https://doi.org/10.1111/acer.15194

Kilpatrick, D. G., Resnick, H. S., Ruggiero, K. J., Conoscenti, L. M., & McCauley, J. (2007). *Drug-facilitated, incapacitated, and forcible rape: A national study* (pp. 667182007-001). Charleston, SC: National Criminal Justice Reference Service.

Kimerling, R., & Calhoun, K. S. (1994). Somatic symptoms, social support, and treatment seeking among sexual assault victims. *Journal of Consulting and Clinical Psychology*, *62*, 333–340. DOI:10.1037/0022-006X.62.2.333

Koss, M. P., Abbey, A., Campbell, R., Cook, S., Norris, J., Testa, M., Ullman, S., West, C., & White, J. (2007). Revising the SES: A collaborative process to improve assessment of sexual aggression and victimization. *Psychology of Women Quarterly*, *31*(4), 357-370.

Krebs, C., Lindquist, C., Berzofsky, M., Shook-Sa, B., Peterson, K., Planty, M., & Stroop, J. (2016). *Campus climate survey validation study: Final technical report*. Washington, DC: BJS, Office of Justice Programs. Retrieved from: http://www.bjs.gov/content/pub/pdf/ccsvsftr.pdf

Krebs, C. P., Lindquist, C. H., Warner, T. D., Fisher, B. S., & Martin, S. L. (2007). The campus sexual assault (CSA) study: Final report. *Washington, DC: National Institute of Justice, US Department of Justice*.

Kuntsche, E., Knibbe, R., Gmel, G., & Engels, R. (2005). Why do young people drink? A review of drinking motives. *Clinical psychology review*, *25*(7), 841-861. https://doi.org/10.1016/j.cpr.2005.06.002

Larimer, M. E., & Cronce, J. M. (2007). Identification, prevention, and treatment revisited: Individual-focused college drinking prevention strategies 1999–2006. *Addictive Behaviors, 32*(11), 2439–2468. https://doi.org/10.1016/j.addbeh.2007.05.006

Lazarus, R. S., & Folkman, S. (1984). Stress, appraisal, and coping. New York: Springer

Linehan, M. M. (1993). *Cognitive-behavioral treatment for borderline personality disorder*. Guilford Press.

Linehan, M. M. (2014). *DBT skills training manual* (2nd ed.). Guilford Publications.

Littleton H., Grills-Taquechel A., & Axsom D. (2009). Impaired and incapacitated rape victims: Assault characteristics and post-assault experiences. *Violence and Victims, 24*, 439–457. DOI:10.1891/0886- 6708.24.4.439.

Littleton, H., & Henderson, C. E. (2009). If she is not a victim, does that mean she was not traumatized? Evaluation of predictors of PTSD symptomatology among college rape victims. *Violence against women*, *15*(2), 148-167.

Lorenz, K. & Ullman, S. E. (2016). Alcohol and sexual assault victimization: Research findings and future directions. *Aggression and Violent*

Lorah, J. A. (2022). Interpretation and visualization of moderation effects and random slopes in multilevel models. The Quantitative Methods for Psychology, 18(1), 111–127. doi:10.20982/tqmp.18

Marx, B. P., Heidt, J. M., & Gold, S. D. (2005). Perceived uncontrollability and unpredictability, self-regulation, and sexual revictimization. Review of General Psychology, 9, 67-90. https://doi.org/10.1037/1089-2680.9.1.67

McCauley, J., Ruggiero, K. J., Resnick, H. S., Conoscenti, L. M., & Kilpatrick, D. G. (2009). Forcible, drug-facilitated, and incapacitated rape in relation to substance use problems: Results from a national sample of college women. *Addictive Behaviors*, *34*(5), 458-462. DOI: 10.1016/j.addbeh.2008.12.004

Miranda Jr, R., Meyerson, L. A., Long, P. J., Marx, B. P., & Simpson, S. M. (2002). Sexual assault and alcohol use: Exploring the self-medication hypothesis. *Violence and victims*, *17*(2), 205. DOI: 10.1891/vivi.17.2.205.33650

Mohler-Kuo M., Dowdall G. W., Koss M. P., Wechsler H. (2004). Correlates of rape while intoxicated in a national sample of college women. *Journal of Studies on Alcohol*, 65, 37–45.

Molstad, T. D., Weinhardt, J. M., & Jones, R. (2023). Sexual assault as a contributor to academic outcomes in university: A systematic review. *Trauma, Violence, & Abuse*, *24*(1), 218-230. https://doi.org/10.1177/152483802110302

Monti, P. M., Kadden, R. M., Rohsenow, D. J., Cooney, N. L., & Abrams, D. B. (2002). *Treating Alcohol Dependence: A Coping Skills Training Guide* (2nd ed.). Guilford Press.

National Institute on Alcohol Abuse and Alcoholism. (2003). Task force on recommended questions of the National Council on Alcohol Abuse and Alcoholism. Recommended sets of alcohol consumption questions. https://www.niaaa.nih.gov/sites/default/files/section%202a_Final_2_10_15.pdf

National Institute on Alcohol Abuse and Alcoholism (2025). *Understanding binge drinking.* https://www.niaaa.nih.gov/publications/brochures-and-fact-sheets/binge-drinking

National Sexual Violence Resource Center (n.d.). *Let's talk: Definitions of terms*. https://www.nsvrc.org/lets-talk-campus/definitions-of-terms

Neighbors, C., Larimer, M. E., & Lewis, M. A. (2004). Targeting misperceptions of descriptive drinking norms: Efficacy of a computer-delivered personalized normative feedback intervention. *Journal of Consulting and Clinical Psychology, 72*(3)*,* 434–447. https://doi.org/10.1037/0022-006X.72.3.434

Neilson, E. C., John, J., Gootee, J., Smith, L., Launius, K., & Farren, E. (2025). Alcohol intoxication, sexual misperception, and sexual assault perpetration: The role of sexual

drive–related alcohol expectancies. *Applied Cognitive Psychology*, *39*(3), e70081. https://doi.org/10.1002/acp.70081

Office on Violence Against Women. (2023). *Sexual assault.* U.S. Department of Justice. https://www.justice.gov/ovw/sexual-assault

Pacella, M. L., Hruska, B., & Delahanty, D. L. (2012). The physical health consequences of PTSD and PTSD symptoms: A meta-analytic review. *Journal of Anxiety Disorders*, **27**, 33–46. doi:10.1016/j.janxdis.2012.08.004

Patterson, D., Greeson, M., & Campbell, R. (2009). Understanding rape survivors' decisions not to seek help from formal social systems. *Health & Social Work*, *34*(2), 127-136.

Pineles, S. L., Mostoufi, S. M., Ready, C. B., Street, A. E., Griffin, M. G., & Resick, P. A. (2011). Trauma reactivity, avoidant coping, and PTSD symptoms: a moderating relationship?. *Journal of abnormal psychology*, *120*(1), 240.

Rape, Abuse & Incest National Network. (2009). Key terms and phrases. Retrieved from https://rainn.org/news-room/key-terms-sexual-violence

Sadler, A. G., Booth, B. M., Nielson, D., & Doebbeling, B. N. (2000). Health-related consequences of physical and sexual violence: Women in the military. Obstetrics & Gynecology, 96(3), 473-480.

Sanjuan, P. M., Langenbucher, J. W., & Labouvie, E. (2009). The role of sexual assault and sexual dysfunction in alcohol/other drug use disorders. *Alcoholism Treatment Quarterly*, *27*(2), 150-163. https://doi.org/10.1080/07347320902785541

Sarkar, N. N., & Sarkar, R. (2005). Sexual assault on woman: Its impact on her life and living in society. *Sexual and Relationship Therapy*, *20*(4), 407-419. https://doi.org/10.1080/14681990500249502

Sayette, M. A. (1999). Does drinking reduce stress?. *Alcohol Research & Health*, *23*(4), 250-255.

Schou-Bredal, I., Bonsaksen, T., Ekeberg, Ø., Skogstad, L., Grimholt, T. K., Lerdal, A., & Heir, T. (2020). Sexual Assault and the Association with Health, Quality of Life, and Self Efficacy in the General Norwegian Population. Journal of Interpersonal Violence, 1-24. DOI: 0886260520926307.

Sexual Assault Kit Initiative (n.d.). Victim or survivor: Terminology from investigation through prosecution. Retrieved from https://sakitta.org/toolkit/docs/Victim-or-Survivor-Terminology-from-Investigation-Through-Prosecution.pdf

Simpson, T. L., Stappenbeck, C. A., Luterek, J. A., Lehavot, K., & Kaysen, D. L. (2014). Drinking motives moderate daily relationships between PTSD symptoms and alcohol use. *Journal of Abnormal Psychology*, *123*(1), 237. DOI: 10.1037/a0035193

Smith, K. Z., Smith, P. H., & Grekin, E. R. (2014). Childhood sexual abuse, distress, and alcohol-related problems: Moderation by drinking to cope. *Psychology of Addictive Behaviors*, *28*(2), 532.

Snijders, T. A. B., & Bosker, R. J. (2012). Multilevel analysis: An introduction to basic and advanced multilevel modeling. Los Angeles: Sage.

Stappenbeck, C. A., Hassija, C. M., Zimmerman, L., & Kaysen, D. (2015). Sexual assault related distress and drinking: The influence of daily reports of social support and coping control. *Addictive behaviors*, *42*, 108-113. https://doi.org/10.1016/j.addbeh.2014.11.013

Stappenbeck, C. A., Jaffe, A. E., Blayney, J. A., Kirwan, M., George, W. H., & Davis, K. C. (2023a). An event-level evaluation of women's self-medicated drinking: The role of sexual assault severity, affect, and drinking motives. *Psychological trauma: theory, research, practice, and policy*, *15*(1), 110. https://doi.org/10.1037/tra0001278

Stappenbeck, C. A., Hammett, J. F., Gulati, N. K., & Kaysen, D. (2023b). Preliminary efficacy of a web-based alcohol and emotion regulation intervention on intimate partner aggression among college women. *Psychology of violence*, *13*(3), 258.

Surìs, A., Lind, L., Kashner, T. M., & Borman, P. D. (2007). Mental health, quality of life, and health functioning in women veterans differential outcomes associated with military and civilian sexual assault. *Journal of Interpersonal Violence*, **22**, 179–197. doi:10.1177/0886260506295347

Tjaden, P. G., & Thoennes, N. (2006). Extent, nature, and consequences of rape victimization: Findings from the National Violence Against Women Survey. Washington, DC: U.S. Department of Justice, Office of Justice Programs, National Institute of Justice.

Trantham-Davidson, H., Burnett, E. J., Gass, J. T., Lopez, M. F., Mulholland, P. J., Centanni, S. W., Floresco, S. B., & Chandler, L. J. (2014). Chronic alcohol disrupts dopamine receptor activity and the cognitive function of the medial prefrontal cortex. *Journal of Neuroscience*, *34*(10), 3706-3718. https://doi.org/10.1523/JNEUROSCI.0623-13.2014

Tipsword, J. M., Brown-Iannuzzi, J. L., Jones, A. C., Flores, J., & Badour, C. L. (2022). Avoidance coping partially accounts for the relationship between trauma-related shame and PTSD symptoms following interpersonal trauma. *Violence against women*, *28*(1), 107-125. https://doi.org/10.1177/1077801220988350

Turner, S., Mota, N., Bolton, J., & Sareen, J. (2018). Self-medication with alcohol or drugs for mood and anxiety disorders: A narrative review of the epidemiological literature. *Depression and anxiety*, *35*(9), 851-860. **https://doi.org/10.1002/da.22771**

Ullman, S. E. (2007). Mental health services seeking in sexual assault victims. *Women & Therapy*, 30, 61–84. doi:10.1300/J015v30n01_04

Ullman, S. E., Relyea, M., Peter-Hagene, L., & Vasquez, A. L. (2013). Trauma histories, substance use coping, PTSD, and problem substance use among sexual assault victims. *Addictive behaviors*, *38*(6), 2219-2223. https://doi.org/10.1016/j.addbeh.2013.01.027

Ullman, S. E., Starzynski, L. L., Long, S. M., Mason, G. E., & Long, L. M. (2008). Exploring the relationships of women's sexual assault disclosure, social reactions, and problem drinking. *Journal of interpersonal violence*, *23*(9), 1235-1257.

van Berlo, W., & Ensink, B. (2000). Problems with Sexuality after Sexual Assault. *Annual Review of Sex Research*, *11*(1), 235–257. https://doi.org/10.1080/10532528.2000.10559789

Votaw, V. R., & Witkiewitz, K. (2021). Motives for substance use in daily life: A systematic review of studies using ecological momentary assessment. *Clinical Psychological Science*, *9*(4), 535-562. DOI: 10.1177/2167702620978614

Wagenaar, W. A. (1986). My memory: A study of autobiographical memory over six years. *Cognitive psychology*, *18*(2), 225-252. DOI: 10.1016/0010-0285(86)900137

Walsh, K., Gilmore, A. K., Frazier, P., Ledray, L., Acierno, R., Ruggiero, K. J., Kilpatrick, D. G., & Resnick, H. S. (2017). A randomized clinical trial examining the effect of video-based prevention of alcohol and marijuana use among recent sexual assault victims. *Alcoholism: Clinical and Experimental Research*, *41*(12), 2163-2172. **https://doi.org/10.1111/acer.13505**

Walters, S. T., Vader, A. M., & Harris, T. R. (2007). A controlled trial of web-based feedback for heavy drinking college students. *Prevention Science, 8*(1), 83–88. https://doi.org/10.1007/s11121-006-0059-9

Weathers, F. W., Litz, B. T., Keane, T. M., Palmieri, P. A., Marx, B. P., & Schnurr, P. P. (2013). The PTSD checklist for DSM-5 (PCL-5). Retrieved from the National Center for PTSD. Retrieved from www.ptsd.va.gov.

Weitzel, J. A., Bernhardt, J. M., Usdan, S., Mays, D., & Glanz, K. (2007). Using wireless handheld computers and tailored text messaging to reduce negative consequences of drinking alcohol. *Journal of Studies on Alcohol and Drugs, 68*(4), 534–537. https://doi.org/10.15288/jsad.2007.68.534

Williamson, J., & Serna, K. (2018). Reconsidering forced labels: Outcomes of sexual assault survivors versus victims (and those who choose neither). *Violence Against Women*, *24*(6), 668-683. https://doi.org/10.1177/1077801217711268.

Yoshimoto, K., McBride, W. J., Lumeng, L., & Li, T. K. (1992). Alcohol stimulates the release of dopamine and serotonin in the nucleus accumbens. *Alcohol*, *9*(1), 17-22. https://doi.org/10.1016/0741-8329(92)90004-T