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Posttraumatic Stress Symptoms and Alcohol Outcomes: The Mediating Role of Drinking Motives and Protective Behavioral Strategies

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POSTTRAUMATIC STRESS SYMPTOMS AND ALCOHOL OUTCOMES: THE
MEDIATING ROLE OF DRINKING MOTIVES AND PROTECTIVE
BEHAVIORAL STRATEGIES

by

Hallie Ray Jordan

A Dissertation
Submitted to the Graduate School,
the College of Education and Human Sciences
and the School of Psychology
at The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

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ABSTRACT

The present study evaluated the sequentially mediating role of drinking motives (i.e. social, enhancement, coping, conformity) and alcohol protective behavioral strategy (PBSA) subtypes (i.e. serious harm reduction [SHR], stopping/limiting drinking [SLD], manner of drinking [MOD]) on the relationships posttraumatic stress symptoms had with hazardous drinking and alcohol-related negative consequences in college students. Participants were 492 (50.8% men) traditional age (i.e. 18 to 25 years old) college students reporting past 30 day alcohol consumption and the experience of at least one potentially traumatic event over their lifetime. Participants reported their gender and completed measures of posttraumatic stress symptoms, drinking motives, PBS use, and hazardous drinking through an online survey. Posttraumatic stress symptoms were positively associated with hazardous drinking and this relationship was partially mediated by coping and enhancement drinking motives independently, as well as sequentially by social drinking motives and PBSA-SHR, enhancement drinking motives and PBSA-SHR, and social drinking motives and PBSA-SLD. Further, posttraumatic stress symptoms were positively associated with alcohol-related negative consequences and this relationship was partially mediated by coping drinking motives independently, as well as sequentially by enhancement drinking motives and PBSA-SHR as well as conformity drinking motives and PBSA-SHR. Thus, types of drinking motives and PBSA use function differentially to account for some of the relationships between posttraumatic stress symptoms and alcohol outcomes.

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DEDICATION

I would like to dedicate this dissertation to my family, for the unconditional love, steadfast belief, and positive encouragement provided throughout my entire life. To my parents, Shawn and Amy Jordan, for genuinely always believing in me and being my biggest cheerleaders and comforters. To my siblings, Taylor and Thomas Jordan, for always giving me a hard time, in the best way, and sharing in my successes with me through the incredible things they are both doing. Big Three for life. To my grandparents, Johnny and Patty Jordan, David and Pam Ray, and Nancy Haskin, for the strong foundations you have built and maintained for our family. And finally, to Zack Weilenman, whose partnership has not only encouraged me to pursue my passions, but also illuminated and enriched my life. Each of these individuals, plus many more, undoubtedly contributed to the successful completion of this project.

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CHAPTER I - INTRODUCTION

College student drinking is a major public health concern given the number of college students consuming alcohol, the resulting alcohol-related negative consequences, and additional factors such as the coexistence of mental health problems and alcohol misuse (National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2015). Approximately two-thirds (67%) of college students report trying alcohol, and 34% of college students report binge drinking (defined as five or more drinks for men and four or more drinks for women in two hours or less; NIAAA, 2015), which is an element of hazardous alcohol use (Schulenberg, Johnston, O'Malley, Bachman, Miech, & Patrick, 2017). These college student drinking behaviors are of paramount concern given the subsequent alcohol-related negative consequences, which can range in severity from relatively minor experiences such as a hangover or missed class to severe and even life-threatening experiences, such as sexual assault, legal trouble, and physical injury or death (White & Hingson, 2014). General trends show college men drink significantly more than college women (e.g., Madson & Zeigler-Hill, 2013), although this gap is narrowing (Schulenberg et al., 2017). Thus, it is important to further understand how alcohol use behaviors and the experience of alcohol consequences function for college men and women.

Mental Health in College Students

The rates of mental health problems in college students is problematic as excessive alcohol use and negative mental health outcomes commonly co-occur (e.g., Kenney & LaBrie, 2013). One in five college students report past-year mental illness (Substance Abuse and Mental Health Services Administration [SAMHSA], 2015), yet

many students experience these problems at a subclinical level (i.e. below clinical diagnostic thresholds). Generally, mental health problems have been associated with increased alcohol use and alcohol-related negative consequences (e.g., Kenney & LaBrie, 2013; LaBrie, Kenney, & Lac, 2010). For example, the experience of general psychological distress has been associated with greater levels of hazardous alcohol use and alcohol-related negative consequences in college samples (Jordan, Villarosa-Hurlocker, Ashley, & Madson, 2018). Specifically, a clear link between posttraumatic stress disorder (PTSD) – and its subclinical presentation of traumatic stress symptoms – and greater alcohol consumption and alcohol-related negative consequences has been established (e.g., Berenz et al., 2016; Jordan, Madson, Nicholson, Bravo, Pearson, & Protective Strategies Study Team, 2019; Kaysen et al., 2013; Tripp, McDevitt-Murphy, Avery, & Bracken, 2015). Given this established relationship between posttraumatic stress and alcohol-related outcomes, it is important to explore the nuances of factors that may help explain this relationship in college students.

Posttraumatic Stress Symptoms

Posttraumatic stress symptoms include the experience of psychological distress resulting from the experience of a traumatic event (American Psychological Association [APA], 2016) and may emerge in levels lower than diagnostic thresholds following a traumatic event yet still cause significant distress (Borsari, Read, & Campbell, 2008). Read, Ouimette, White, Colder, and Farrow (2011) found 66% of college students reported experiencing a trauma at some point in their lives and 9% reported the presence of posttraumatic stress symptoms connected to a traumatic event meeting PTSD diagnostic criteria. More recently, Jordan and colleagues (2019) found that approximately

18% of a national sample of college students met the recommended clinical cutoff score on a measure of PTSD symptomology (i.e. the Posttraumatic Stress Disorder Checklist for DSM-5; Weathers, Litz, et al., 2013) for a PTSD diagnosis, although exposure to a traumatic event was not formally assessed. Moreover, traumatic stress symptoms are positively associated with alcohol consumption and alcohol-related negative consequences (e.g., Berenz et al., 2016; Jordan et al., 2019; Kaysen et al., 2013; Tripp et al., 2015). This relationship has been reported for college men and women (e.g., Read, Griffin, Wardell, & Ouimette, 2014); however, it appears stronger for women compared to men (Berenz et al., 2016). This finding highlights the importance of including gender to increase our understanding of how myriad factors influence the dynamics between trauma experience, traumatic stress symptoms, and alcohol-related behaviors and outcomes.

Despite the high overall rates of reported mental health problems for college students (i.e. 20-50%), only 11 (SAMHSA, 2015) to 20% (Blanco et al., 2008) of these students sought treatment for mental health concerns. When considering the low rates of treatment seeking in conjunction with high rates of mental health problems such as posttraumatic stress, concerns emerge about how college students are coping with distress. One such way may be through substance use, and specifically alcohol use.

Drinking Motives

Considering students' intentions for alcohol use includes the evaluation of drinking motives, which appear to be the most proximal predictor of alcohol use regardless of age or college status and serve to describe the reasons individuals decide to consume alcohol (Cooper, 1994). Drinking motives can be valued as positively (i.e.

social, enhancement) or negatively reinforcing (i.e. coping, conformity; Cooper, 1994). Additionally, drinking motives can be internally (i.e. coping, enhancement) or externally (i.e. social, conformity) based (Cooper, 1994). Social drinking motives occur when an individual consumes alcohol to obtain a socially related reward or positive experience and are associated with increased quantity and frequency of alcohol use. Enhancement drinking motives are also positively reinforcing; however, they represent internal rewards such that the individual is motivated to consume alcohol to improve a positive mood or experience and are associated with increased quantity and frequency of alcohol use as well as increased heavy drinking. Coping drinking motives occur when an individual is motivated to use alcohol to cope, or deal with, the internal experience of negative affect, and while conformity drinking motives are negatively reinforcing, they are external, such that these individuals are consuming alcohol to fit in with a social situation to avoid negative social experiences. Coping and conformity drinking motives are associated with greater quantity and frequency of alcohol use as well as the experience of more alcohol-related problems.

Generally, negatively reinforcing drinking motives (i.e. coping and conformity) are associated with heavier drinking (Corbin, Farmer, & Nolen-Hoeksema, 2013) and more alcohol-related problems (Patrick, Lee, & Larimer, 2011), especially when compared to positive drinking motives (i.e. social and enhancement; Kuntsche, Knibbe, Gmel, & Engels, 2005). Drinking to cope may be a form of coping through avoidance, and Ehrenberg, Armeli, Howland, and Tennen (2016) found individuals reported greater coping drinking motives on days when they reported experiencing greater negative affect and using more avoidance coping behaviors. These findings support that substance use is

not only a way to cope with distress, but it is a way to cope with distress in a less healthy, avoidant manner. In contrast, Walker and Stephens (2014) found that drinking to cope motives did not explain the relationship between avoidant coping and alcohol use behaviors, although they noted low reliability of their measurement of avoidance coping. Perhaps this conflicting finding with Ehrenberg and colleagues (2016), barring reliability issues, suggests that factors in addition to coping drinking motives are influential in the relationship between avoidant coping and alcohol use behaviors. For example, the use of alcohol protective behavioral strategies (PBSA) and existing mental health problems could be interacting with coping drinking motives to influence drinking behaviors.

Drinking Motives and Posttraumatic Stress Symptoms

Relationships between negatively reinforcing drinking motives and alcohol outcomes (i.e. greater alcohol consumption and alcohol-related problems) have been established (e.g., Cooper, 1994; Corbin et al., 2013; Kuntchse et al., 2005) and there are other proximal factors, such as one's experience of various types of distress (e.g. stress, negative affect, mental health problems), that are associated with more negatively reinforcing drinking motives (see Corbin et al., 2013; Read et al., 2014; Villarosa et al., 2018). This association may be explained by the Self-Medication Theory (SMT) which posits that individuals experiencing various forms of distress may attempt to cope with that distress through using substances to reduce tension (e.g., Maisto, Bishop, & Hart, 2012). Researchers have found support for this model through showing increases in individuals' pre-trauma and post-trauma substance use (alcohol and drug) were due to posttraumatic stress symptoms (Haller & Chassin, 2014). Further, negatively reinforcing drinking motives tend to influence the link between posttraumatic stress symptoms and

alcohol-related outcomes (e.g., Aarstad-Martin & Boyraz, 2017; Read et al., 2014) and may represent attempts to cope with distressing symptoms.

Researchers have primarily tested the role of coping drinking motives in the relationship between posttraumatic stress symptoms and alcohol outcomes and have found these motives to partially explain the positive association between PTSD symptoms and alcohol outcomes (e.g., Simpson, Stappenbeck, Luterek, Lehavot, & Kaysen, 2014). However, the results are mixed when examining this relationship among men and women. For example, Lehavot and colleagues (2014) found posttraumatic stress symptoms were associated with greater alcohol consumption through stronger drinking to cope motives for women but not men (Lehavot et al., 2014), but Corbin and colleagues (2013) found men reported greater drinking to cope motives in the context of general stress. However, other researchers (e.g., Aarstad-Martin & Boyraz, 2017; Read et al., 2014) have found these relationships did not differ between men and women. In addition to coping drinking motives, evidence supports the role of enhancement drinking motives in the relationship between posttraumatic stress symptoms and drinking outcomes (e.g., Simpson et al., 2014). For example, Lehavot and colleagues (2014) found that posttraumatic stress symptom severity was positively associated with enhancement drinking motives, but only for men. Similarly, enhancement drinking motives have been found to mediate the relationship between a specific traumatic experience (i.e. childhood sexual assault) and alcohol use problems in adult women (Grayson & Nolen-Hoeksema, 2005).

Not all research on the role of drinking motives in the relationships between posttraumatic stress symptoms and alcohol outcomes has produced consistent findings.

For example, while posttraumatic stress symptom severity and conformity drinking motives have been positively associated (Nugent, Lally, Brown, Knopik, & McGeary, 2012), they have not emerged as a significant factor influencing the relationship between posttraumatic stress symptoms and same-day-drinking (Simpson et al., 2014). Furthermore, social drinking motives have not emerged as associated with posttraumatic stress symptoms (Nugent et al., 2012) or as influential in the relationship between posttraumatic stress symptoms and alcohol-related outcomes (Simpson et al., 2014). Thus, posttraumatic stress symptoms appear to be most strongly and consistently associated with coping and enhancement drinking motives, while the impact of conformity and social drinking motives appears inconsistent or minimal. Given the evidence supporting the role of coping and enhancement drinking motives on the relationship between posttraumatic stress symptoms and alcohol outcomes, it is important to identify potential protective factors in these relationships (Aarstad-Martin & Boyraz, 2017). One such factor may be the use of alcohol protective behavioral strategies (PBSA; Jordan et al., 2019).

Alcohol Protective Behavioral Strategies

Alcohol protective behavioral strategies (PBSA) are behaviors individuals can use with the intention to minimize risk when drinking (Madson, Arnau, & Lambert, 2013a; Martens et al., 2004; Treloar, Martens, & McCarthy, 2015). The harm reduction approach of PBSA may be more appealing to college students versus abstinence messages because they allow for a safer level of drinking to occur (e.g., Pearson, 2013). Generally, PBSA use has been associated with less alcohol consumption, less hazardous drinking, and experiencing fewer alcohol-related negative consequences for college students (e.g.,

Madson, Moorer, Zeigler-Hill, Bonnell, & Villarosa, 2013b). Thus, PBSA have emerged as an essential component to study to further understand the nature of college student drinking (Pearson, 2013).

Although PBSA can be examined as a total set of behaviors, there are different types of PBSA which appear to have differential effects on alcohol outcomes (Madson et al., 2013a; Treloar et al., 2015). PBSA include direct behaviors in which the individual is altering alcohol consumption in some way as well as indirect behaviors in the context of an alcohol-consuming environment, but not the alcohol use itself (DeMartini et al., 2012). Direct strategies include behaviors focused on how one is drinking (manner of drinking; PBSA-MOD, e.g., avoiding drinking games) and how long one is drinking (stopping/limiting drinking; PBSA-SLD, e.g., leave the bar/party at a set time), and indirect strategies focused on reducing harm associated with drinking (serious harm reduction; PBSA-SHR, e.g., using a designated driver; Treloar et al., 2015). Dismantling PBSA into their types provides useful information about the differential effects that is not achieved when examining the construct as a whole (e.g., Bravo, Prince, & Pearson, 2017).

Evidence has emerged showing that PBSA-MOD and PBSA-SLD, but not PBSA-SHR, are associated with less alcohol consumption and less hazardous drinking (e.g., DeMartini et al., 2012; Pearson, D'Lima, & Kelley, 2013). Although we do not see many inverse relationships between PBSA-SHR and consumption, there is an established negative association between PBSA-SHR and alcohol-related negative consequences (e.g., DeMartini et al., 2012; Napper, Kenney, Lac, Lewis, & LaBrie, 2014; Villarosa, Moorer, Madson, Zeigler-Hill, Noble, 2014). Further, demographic factors have

predicted differential use of PBSA (e.g., Barry, Madson, Moorer, & Christman, 2016, Madson et al., 2013b, Pearson, 2013). For example, studies consistently show men tend to use fewer PBSA than women (e.g., LaBrie, Hummer, Kenney, Lac, & Pederson, 2011; Madson et al., 2013b; Pearson, 2013; Walters, Roudsari, Vader, & Harris, 2007), which highlights the importance of continuing to understand how different characteristics (e.g., gender) impact PBSA use to inform areas rich for prevention or intervention efforts related to PBSA education and implementation (Whitley, Madson, & Zeigler-Hill, 2018).

PBSA and Mental Health

College students with mental health problems tend to report using fewer PBSA than their peers with better mental health (e.g., Jordan et al., 2018; Villarosa et al., 2018); however, when these individuals do use PBSA, they report less alcohol consumption and fewer alcohol-related negative consequences (e.g., Kenney & LaBrie, 2013; LaBrie, Kenney, Lac, Garcia, & Ferraiolo, 2009). For example, Villarosa and colleagues (2018) found greater depressive symptoms were associated with less controlled consumption PBSA (i.e. combined MOD/SLD subscales) and PBSA-SHR use, which was in turn associated with greater consumption, harmful drinking, and alcohol-related negative consequences. This relationship is hypothesized in part to be due to the self-medication hypothesis, such that those with depressive symptoms engaging in alcohol use may be drinking to cope with their symptoms, and thus less motivated to engage in PBSA use because PBSA use would hinder their ultimate goals for drinking (e.g., tension reduction).

To date only one study has examined the relationships between traumatic stress and PBSA subtypes and found the three PBSA subtypes differentially moderated the

relationships between posttraumatic stress symptoms and alcohol-related negative consequences (Jordan et al., 2019). Specifically, the positive association between posttraumatic stress symptoms and alcohol-related negative consequences was weaker among women using greater PBSA-SLD, but stronger among men using greater PBSA-SLD, while a weaker relationship emerged between posttraumatic stress symptoms and alcohol-related negative consequences when men (but not women) used more PBSA-MOD. Finally, although PBSA-SHR use weakened the relationship between posttraumatic stress symptoms and alcohol-related negative consequences for men and women, testing moderation effects of gender demonstrated that PBSA-SHR only weakened the relationship at high levels of PBSA-SHR use for women but not men. Thus, there appears to be an additionally protective value of using PBSA for those experiencing posttraumatic stress symptoms. However, as individuals who use alcohol to self-medicate posttraumatic stress symptoms (i.e. drinking to cope) may feel as if PBSA use would interfere with their drinking goals, it is important to understand the interplay between drinking motives and PBSA use in the larger context of posttraumatic stress and alcohol outcomes.

PBSA and Drinking Motives

Generally, PBSA tend to mediate the positive relationship between drinking motives and alcohol use (LaBrie, Lac, Kenney, & Mirza, 2011) as more salient drinking motives are associated with less use of PBSA, which is in turn associated with elevated alcohol-related outcomes (i.e. use and consequences; e.g., Bravo, Prince, & Pearson, 2015; Ebersole, Noble, & Madson, 2012; Martens, Ferrier, & Cimini, 2007). In the context of depressive symptoms, Villarosa and colleagues (2018) found that coping with

depression motives were negatively associated with controlled consumption PBSA, which in turn partially explained the positive relationship between coping with depression motives and alcohol consumption and hazardous drinking. Further, coping with depression motives were associated with using fewer PBSA-SHR, and PBSA-SHR mediated the positive relationship between coping with depression motives and alcohol-related negative consequences. Additionally, while conformity drinking motives were not associated with controlled consumption PBSA they were negatively associated with PBSA-SHR. Specifically, greater conformity drinking motives were related to less PBSA-SHR use which was in turn associated with greater alcohol-related negative consequences. These findings highlight the importance of continuing to explore how the relationships between drinking motives and alcohol-related outcomes are impacted by PBSA subtypes, particularly in populations reporting mental health problems (Villarosa et al., 2018).

Present Study

The positive associations posttraumatic stress symptoms have with hazardous drinking and alcohol-related negative consequences has been well established (e.g., Berenz et al., 2016; Borsari et al., 2008; Kaysen et al., 2013) and appears impacted by greater coping (Aarstad-Martin & Boyraz, 2017; Lehavot et al., 2014; Simpson et al., 2014) and enhancement drinking motives (Grayson & Nolen-Hoeksema, 2005; Simpson et al., 2014), but not greater conformity (Simpson et al., 2014) or social (Nugent et al., 2012; Simpson et al., 2014) drinking motives. All four drinking motives (i.e. social, enhancement, coping, conformity) are salient for men and women; however, the degree to which women and men report particular drinking motives can vary and appear

inconsistent in the literature (e.g., Aarstad-Martin & Boyraz, 2017; Lehavot et al., 2014). To date, only one study has examined the role of PBSA use in the relationship between posttraumatic stress and alcohol-related negative consequences; however, no studies have explored posttraumatic stress, drinking motives, PBSA, and alcohol-related outcomes in one model, or examined how these relationships may be impacted by gender. The present study seeks to understand how the relationships between posttraumatic stress symptoms and alcohol outcomes are explained by drinking motives and PBSA types. The degree to which these relationships are invariant by gender will also be explored.

Question 1: To what degree are the relationships posttraumatic stress symptoms have with hazardous drinking and alcohol-related negative consequences sequentially mediated by drinking motives (i.e. social, enhancement, coping, conformity) and PBSA use (i.e. SHR, SLD, MOD)?

Hypothesis 1a: The positive relationship between posttraumatic stress symptoms and hazardous drinking will be mediated by coping and enhancement drinking motives as well as PBSA-SLD and PBSA-MOD use.

Hypothesis 1b: The positive relationship between posttraumatic stress symptoms and alcohol-related negative consequences will be mediated by coping and enhancement drinking motives as well as PBSA-SHR use.

Question 2: To what degree is the sequential relationship between posttraumatic stress symptoms, drinking motives, PBSA use, and alcohol outcomes invariant by gender?

Hypothesis 2: The sequentially mediating effects of drinking motives and PBSA on the relationship between posttraumatic stress symptoms and alcohol outcomes will vary by gender.

CHAPTER II - METHOD

Participants and Procedures

Participants were 492 (50.8% men) undergraduate traditional age (i.e. 18 to 25 years old) college students ($M = 22.33$, $SD = 2.02$) who reported consuming alcohol at least once in the past 30 days, attending college primarily on-campus in the United States, the experience of at least one potentially traumatic event over their lifetime, and at least one posttraumatic stress symptom. Most participants were White (61.0%), followed by Asian American (19.3%), African American/Black (9.0%), Native American (3.5%), Other (3.0%), Multiracial (2.5%), Eastern Indian American (1.1%), and Middle Eastern American (0.5%). The sample consisted of freshmen (10.6%), sophomores (15.9%), juniors (32.2%), and seniors (41.3%). Most of the sample was not affiliated with the military (77.8%), but 11.2% reported active duty status, 8.1% reported reserves status, and 2.9% reported Veteran status. Additional sample characteristics can be found in Tables 1 and 2.

Table 1 *Demographic Characteristics of the Overall Sample (n = 492)*

<i>Demographic</i>	N	%	<i>Demographic</i>	N	%
Region of U.S.			Type of University		
Northeast – New England	34	6.9%	Public/state	313	64.1%
Northeast – Mid Atlantic	73	14.8%	Private	148	30.3%
Southeast	42	8.5%	Liberal Arts College	22	4.5%
Southwest	74	15.0%	Religious Affiliated	5	1.0%
South Atlantic	82	16.7%	Size of School		
Midwest – East North Central	66	13.4%	Less than 2,000 Students	42	8.5%
Midwest – West North Central	38	7.7%	2,000 – 5,000 Students	101	20.5%
West – Mountain	21	4.3%	5,000 – 10,000 Students	122	24.8%
West – Pacific	62	12.6%	10,000 – 15,000 Students	67	13.6%
Marijuana Use			15,000 – 20,000 Students	61	12.4%
Yes	298	61.2%	20,000 – 30,000 Students	49	10.0%
No	189	38.8%	More than 30,000 Students	50	10.2%

Table 2 *Types of Worst Events Identified (n = 492) Measured by the Criterion A Assessment for the Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5)*

Worst Event	N	%
Natural disaster	41	8.3%
Fire or explosion	21	4.3%
Transportation accident	52	10.6%
Serious accident at work, home, or during recreational activity	26	5.3%
Exposure to toxic substance	11	2.2%
Physical assault	35	7.1%
Assault with a weapon	15	3.0%
Sexual assault	63	12.8%
Other unwanted or uncomfortable sexual experience	19	3.9%
Combat or exposure to a warzone	6	1.2%
Captivity	1	0.2%
Life-threatening illness or injury	33	6.7%
Severe human suffering	23	4.7%
Sudden violent death	14	2.8%
Sudden accidental death	22	4.5%
Serious injury, harm, or death you caused to someone else	13	2.6%
Any other very stressful event or experience	97	19.7%

Note. The top five endorsed worst events are presented in bold typeface.

Data were collected using Amazon's MTurk, an online, worldwide data collection service. Participants were tracked via an HTML script from <http://uniqueturker.myleott.com/> to ensure duplicate survey responses did not occur through placing limitations on the number of responses each MTurk participant could provide to the survey. MTurk was used for several reasons, including to promote generalizability due to the nationwide collection capacities and to access a potentially clinical or subclinical population. For example, Shapiro, Chandler, and Mueller (2013) found MTurk to be a reliable, quick method to obtain data from specific clinical or subclinical population, which provides support for using MTurk in the present study to obtain a sample of trauma-exposed individuals also reporting clinical or subclinical traumatic stress symptoms. Further, Kim and Hodgins (2017) found MTurk responses to demonstrate evidence of reliability and validity in the context of alcohol use.

Institutional review board approval was obtained prior to activating the study on MTurk. Upon accessing the study on MTurk, participants were directed to a secure, online survey hosted on Qualtrics where they read and electronically provided informed consent to participate. Participants answered screening questions (i.e. age, whether they are a college student physically attending a college/university in the United States, whether they consumed alcohol in the past 30 days). Those who met all criteria completed additional demographic information prior to completing a survey of questionnaires presented in random order to prevent testing effects. Only participants who endorsed the experience of a potentially traumatic event in the Life Events Checklist for DSM-5 (LEC-5) questionnaire and completed a measure of traumatic stress symptoms (i.e. the Posttraumatic Stress Disorder Checklist for DSM-5) were included in

the present analyses; these two measures were presented on the same page. Two items (e.g., “leave this item blank” or “select response 0 for this item”) were embedded to check for valid responding (Meade & Craig, 2012). Failing one of the two items resulted in the participant’s data being excluded from analysis. Upon completion of 75% of the survey, participants who met eligibility as determined by the screening questions were compensated 50 cents.

Initially, 4,691 hits were obtained, which were then screened using the present study’s inclusion criteria (i.e. age 18-25, attending predominately on-campus courses at a college/university in the United States, consumed alcohol in past 30 days). Participants who were not traditional age college students were excluded ($N = 1,293$) as well as those reporting not attending college in the United States ($N = 578$). Further, 213 denied being currently enrolled as a college student and were excluded, and 117 did not endorse attending courses on-campus and were excluded. Those not consuming alcohol in the past 30 days ($N = 408$) were also excluded. Finally, 101 participants did not complete further survey items because they did not provide informed consent.

Of the 1,981 who met inclusion criteria, 539 participants did not complete at least 75% of the survey and their data were excluded. Those failing the validity items instructing them to “Select 0 for this item” ($N = 227$) and “Leave this item blank” ($N = 13$) were also excluded from the final sample. Three cases did not provide their gender and given gender is a primary variable of interest in the present study, they were removed from the sample. Participants who did not endorse experiencing a potentially traumatic event ($N = 318$) were excluded from the sample. Further, 44 cases were excluded for responding faster than 95% of the sample per recommendations provided by Meade and

Craig (2012), which left 837 cases, and the 51 participants who did not complete at least 75% of every measure included in the present analyses were excluded. Longstring indices were evaluated to determine the longest number of consecutive responses provided by a participant on the PBSS-20 and DMQ-R and cases responding invariantly to more than nine items were excluded (Costa & McCrae, 2008; DeSimone & Harms, 2018; Huang et al., 2012); 100 cases violated the longstring index standard when examining the PBSS-20, and 49 violated when examining the DMQ-R; these cases were excluded. Of the remaining 637 cases, 59 cases did not report any PTSD symptoms on the PCL-5 and were excluded given the present study's focus on posttraumatic stress symptom experience. Finally, 86 cases were removed because they reported their academic status as graduate students. The final sample consisted of 492 students.

Measures

Demographics

Participants reported their age, race, sex, gender identification, academic year in school (i.e. freshman, sophomore, junior, senior), college attendance status (i.e. in-person, online), regional location of college/university, size of college/university, type of college/university (i.e. public, private, religiously affiliated), and military status (i.e. unaffiliated, active duty, reserves, Veteran).

Life Events Checklist for DSM-5 (LEC-5)

The LEC-5 is a 17-item measure assessing the experience of 16 specific potentially traumatic events (e.g., natural disaster, sexual assault) as well as “any other very stressful event or experience” created to correspond with DSM-5 guidelines for potential traumatic event experiences (Weathers, Blake, et al., 2013). Participants

responded to each item with “happened to me,” “witnessed it,” “learned about it,” “part of my job,” “not sure,” or “does not apply.” Participants endorsing “happened to me,” “witnessed it,” “learned about it,” or “part of my job” to at least one item were screened positively for having experienced a potential criterion A trauma (American Psychiatric Association [APA], 2013; Aarstad-Martin & Boyraz, 2017). Participants who endorsed “not sure” or “does not apply” were not included in analyses as the presence of a traumatic event is necessary to meet criteria for PTSD or traumatic stress symptoms (APA, 2013); however, they were still compensated for their participation.

Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5)

The PCL-5 (Weathers, Litz, et al., 2013) is a 20-item measure assessing symptomatology consistent with a DSM-5 diagnosis of PTSD (Blevins, Weathers, Davis, Witte, & Domino, 2015). Prior to completing the PCL-5, but after completing the LEC-5, participants completed an additional assessment (i.e. “Criterion A”) of Criterion A for PTSD which is commonly used to accompany a the LEC-5 and PCL-5 (Weathers, Litz, et al., 2013). This assessment asked participants to briefly describe the worst event they experienced from those listed on the LEC-5 along with additional questions regarding the nature of the event, such as how long ago they experienced the event.

In the PCL-5, participants were asked to keep their worst event in mind from the LEC-5. Specifically, they were asked to select the worst event they have experienced from a drop-down menu in Part A of the PCL-5. If they have not experienced an event from the LEC-5, they were instructed to select “none.” After reporting which LEC-5 event was the worst they had experienced, they were asked to report the degree to which they experienced various symptoms related to that event over the past month using a

Likert-type scale ranging from “0” (not at all) to “4” (extremely). Example symptoms include “repeated, disturbing dreams of the stressful experience,” “feeling very upset when something reminded you of the stressful experience,” and “being ‘superalert’ or watchful or on guard” (Weathers, Litz, et al., 2013). Although the PCL-5 can produce subscores by PTSD symptom cluster, a total of all items (ranging from “0” to “80”) was used to quantify a total traumatic stress symptom score, with higher scores reflecting greater severity of traumatic stress symptoms. The PCL-5 has demonstrated evidence of strong internal consistency ($\alpha = .97$; Jordan et al., 2019) which was replicated in the present sample (i.e. $\alpha = .96$).

Drinking Motives Questionnaire-Revised (DMQ-R)

The DMQ-R is a 20-item measure of the participant’s motives for consuming alcohol (Cooper, 1994). The DMQ-R assessed each type of drinking motive (i.e. social – “because it helps you enjoy a party,” enhancement – “because it gives you a pleasant feeling,” coping – “to forget about your problems,” conformity – “to fit in with a group you like”) with five items per motive. Participants were asked to rate the frequency of their drinking in relation to each statement on a Likert-type scale from “1” (almost never/never) to “5” (almost always/always). Scores for each item on a subscale were totaled for a subscale score ranging from “1” to “25” with higher scores reflecting greater frequency of drinking alcohol in relation to that type of drinking motive. The four-factor structure of the DMQ-R has been supported (Cooper, 1994) and each factor demonstrated evidence of adequate internal consistency in the present sample (social $\alpha = .83$, enhancement $\alpha = .78$, coping $\alpha = .82$ conformity $\alpha = .88$).

Protective Behavioral Strategies Scale-20 (PBSS-20)

The PBSS-20 was used to evaluate one's use of serious harm reduction PBSA (i.e. SHR; eight items, e.g., "use a designated driver"), stopping/limiting drinking PBSA (i.e. SLD; seven items, e.g., "determine not to exceed a set number of drinks"), and manner of drinking PBSA (i.e. MOD; five items, e.g., "avoid drinking games"; Treloar et al., 2015). Participants reported the degree to which they use each PBSA using a Likert-type scale ranging from "1" (never) to "6" (always). Participants' use of specific types of PBSA was produced by adding the items of each subscale, with higher scores reflecting more use of that type of PBSA. PBSA-SHR scores range from "8" to "48," PBSA-SLD scores range from "7" to "42," and PBSA-MOD scores range from "5" to "30." Internal consistency in the present study was good (PBSA-SHR $\alpha = .88$, PBSA-MOD $\alpha = .82$, PBSA-SLD $\alpha = .85$).

Alcohol Use Disorder Identification Test (AUDIT-US-C)

The three-item AUDIT-US consumption (AUDIT-US-C) subscale, a modification of the AUDIT-C (Saunders, Aasland, Babor, De La Fuente, & Grant, 1993) was used to measure hazardous drinking (Centers for Disease Control and Prevention [CDC], 2015; Higgins-Biddle & Babor, 2018). Two of the items (i.e. "in the past year, how often do you have a drink containing alcohol?" and "in the past year, how often do you have 5 drinks (male) or 4 drinks (female) or more on one occasion?") are scored on a seven-point scale ranging from "0" (never) to "6" (daily). The third item (i.e. "in the past year, how many drinks containing alcohol do you have on a typical day when you are drinking?") is scored on a seven-point scale ranging from "0" (1 drink) to "6" (10 or more drinks). Total scores are the sum of all three items and range from 0 to 18, with

greater hazardous drinking reflected by higher scores. The AUDIT-US-C demonstrated evidence of adequate internal consistency, with $\alpha = .77$.

Brief Young Adult Alcohol Consequences Questionnaire (BYAACQ)

The BYAACQ is a 24-item measure evaluating college students' experience of alcohol-related negative consequences (Kahler, Strong, & Read, 2005). Participants were asked to answer "0" (no) or "1" (yes) when asked whether they have experienced a specific problem in the past year. Example items include "when drinking, I have done impulsive things I regretted later," "I have become very rude, obnoxious, or insulting after drinking," and "the quality of my work or school work has suffered because of my drinking." The total number of items endorsed as "yes" were summed to produce a total score ranging from "0" to "24" with higher scores indicating the experience of more alcohol-related negative consequences. In the present analyses, there was evidence of good internal consistency for the BYAACQ ($\alpha = .89$).

CHAPTER III - RESULTS

Participants who met study inclusion criteria and completed at least 75% of the measures were included in the analyses. Missing values were coded as such, and no extreme values or potentially influential data points were identified. Diagnostic statistics were conducted to evaluate the data for violations of normality such as multicollinearity, skewness, and kurtosis; the data met assumptions of normality and no transformations were required.

Descriptive Statistics

Means, standard deviations, and intercorrelations for all measures are presented for the entire sample in Table 3 and for men and women participants separately in Table 4. A majority (i.e., 89.6%) of the sample met or exceeded the AUDIT-US cutoff score of four representing at-risk drinking (Madson et al., 2018), with 92.8% of men and 86.4% of women meeting or exceeding the cutoff for at-risk drinking. Further, 54.9% of the sample met or exceeded the PCL-5 cutoff score of 33 which represents likely positive screening for a DSM-5 diagnosis of PTSD if Criterion A for PTSD has also been met (Weathers, Litz, et al., 2013). See Table 2 for types and frequencies of potentially traumatic events identified as one's worst experience as measured by the LEC-5 and the Criterion A measure for the PCL-5. Posttraumatic stress symptoms were positively correlated with each of the drinking motives, PBSA-SLD, PBSA-MOD, hazardous drinking, and alcohol-related negative consequences, but were not correlated with PBSA-SHR. Because all paths in the mediation model were accounted for, the model is just-identified and global fit statistics are not reported.

Table 3 Overall Sample Means, Standard Deviations, and Intercorrelations ($n = 492$)

Scale	1	2	3	4	5	6	7	8	9	10
1. COPE	-									
2. ENH	.57***	-								
3. CONF	.52***	.41***	-							
4. SOC	.46***	.65***	.33***	-						
5. SHR	.02	.19***	-.15**	.24***	-					
6. SLD	.24***	.17***	.28***	.17***	.40***	-				
7. MOD	.18***	.09*	.24***	.00	.37***	.59***	-			
8. PCL-5	.49***	.20***	.49***	.10***	-.06	.25***	.23***	-		
9. US-C	.44***	.40***	.34***	.31***	.11*	.20***	.15**	.31***	-	
10. ARNC	.44***	.26***	.39***	.18***	-.15**	.08	.05	.39***	.43***	-
Mean	14.62	15.73	12.87	16.63	34.05	24.22	17.69	34.05	8.23	11.86
SD	4.77	4.47	5.26	4.47	8.77	7.77	5.90	19.71	3.58	6.03

Note. * $p < .05$; ** $p < .01$; *** $p < .001$.

COPE = DMQ-R Coping Drinking Motives, ENH = DMQ-R Enhancement Drinking Motives, CONF = DMQ-R Conformity Drinking Motives, SOC = DMQ-R Social Drinking Motives, SHR = PBSS-20 Protective Behavioral Strategies – Serious Harm Reduction, SLD = PBSS-20 Protective Behavioral Strategies – Stopping/Limiting Drinking, MOD = PBSS-20 Protective Behavioral Strategies – Manner of Drinking, PCL-5 = Posttraumatic Stress Disorder Symptoms, US-C = Hazardous drinking measured by the Alcohol Use Disorders Identification Test – United States – Consumption subscale, ARNC = Alcohol-related negative consequences measured by the Brief Young Adult Alcohol Consequences Questionnaire.

Table 4 *Men (n = 250) and Women (n = 242) Means, Standard Deviations, and Intercorrelations*

Scale	1	2	3	4	5	6	7	8	9	10
1. COPE	-	.58***	.54***	.46***	-.05	.19**	.13*	.52***	.43***	.45***
2. ENH	.57***	-	.39***	.63***	.12	.14*	.02	.16*	.41***	.24***
3. CONF	.48***	.43***	-	.33***	-.23***	.31***	.19**	.46***	.32***	.40***
4. SOC	.50***	.68***	.35***	-	.21**	.17**	-.06	.08	.31***	.15*
5. SHR	.14*	.27***	-.04	.26***	-	.31***	.29***	-.04	.20**	-.17**
6. SLD	.30***	.20**	.24***	.16*	.52***	-	.58***	.28***	.23***	.06
7. MOD	.24***	.15*	.30***	.05	.45***	.60***	-	.23***	.22**	.04
8. PCL-5	.47***	.23***	.53***	.12	-.09	.21**	.24***	-	.34***	.40***
9. US-C	.43***	.41***	.33***	.35***	.07	.17**	.09	.29***	-	.41***
10. ARNC	.41***	.29***	.35***	.23***	-.09	.10	.08	.39***	.41***	-
Mean M	15.16	15.72	13.48	16.38	32.82	24.20	17.55	34.19	8.84	12.72
SD M	4.46	4.46	4.92	4.47	8.52	7.52	5.92	19.30	3.37	5.81
Mean W	14.07	15.74	12.24	16.89	35.31	24.25	17.83	33.91	7.60	10.97
SD W	5.02	4.49	5.53	4.40	8.87	8.05	5.88	20.17	3.68	6.14

Note. Correlations for females above the diagonal line and correlations for males below the diagonal line.

* $p < .05$; ** $p < .01$; *** $p < .001$.

COPE = DMQ-R Coping Drinking Motives, ENH = DMQ-R Enhancement Drinking Motives, CONF = DMQ-R Conformity Drinking Motives, SOC = DMQ-R Social Drinking Motives, SHR = PBSS-20 Protective Behavioral Strategies – Serious Harm Reduction, SLD = PBSS-20 Protective Behavioral Strategies – Stopping/Limiting Drinking, MOD = PBSS-20 Protective Behavioral Strategies – Manner of Drinking, PCL-5 = Posttraumatic Stress Disorder Symptoms, US-C = Hazardous drinking measured by the Alcohol Use Disorders Identification Test – United States – Consumption subscale, ARNC = Alcohol-related negative consequences measured by the Brief Young Adult Alcohol Consequences Questionnaire. Mean M = mean score for men participants, SD M = standard deviation for men participants, Mean W = mean score for women participants, SD W = standard deviation for women participants.

Hazardous Drinking

To test hypotheses 1a and b, structural equation modeling (SEM) was used to run a sequential mediation in MPlus Version 8.3 (Meyers et al., 2006; Muthén & Muthén, 2012). Significant mediations were determined on the basis of bootstrapping confidence intervals 5,000 times, represented by a 95% confidence interval of effects that did not include 0 (Preacher & Hayes, 2008). Consistent with hypothesis 1a, posttraumatic stress symptoms positively predicted hazardous drinking ($c = .31, p < .001$; Figure 1). After accounting for the mediating roles of drinking motives and PBSA subtypes, the relationship was reduced but still significant ($c^l = .13, p = .011$), indicating a partial mediation. Consistent with hypothesis 1a, coping ($\beta = .10, 95\% \text{ CI } [.05, .16]$) and enhancement ($\beta = .04, 95\% \text{ CI } [.01, .07]$) drinking motives independently mediated the relationship between posttraumatic stress symptoms and hazardous drinking (i.e. mediated 32.15% and 14.15% of the relationships, respectively). Specifically, posttraumatic stress symptoms positively predicted coping drinking motives ($\beta = .50, p < .001$), which in turn positively predicted hazardous drinking ($\beta = .20, p < .001$). Posttraumatic stress symptoms also positively predicted enhancement drinking motives ($\beta = .20, p < .001$), which in turn positively predicted hazardous drinking ($\beta = .18, p = .002$).

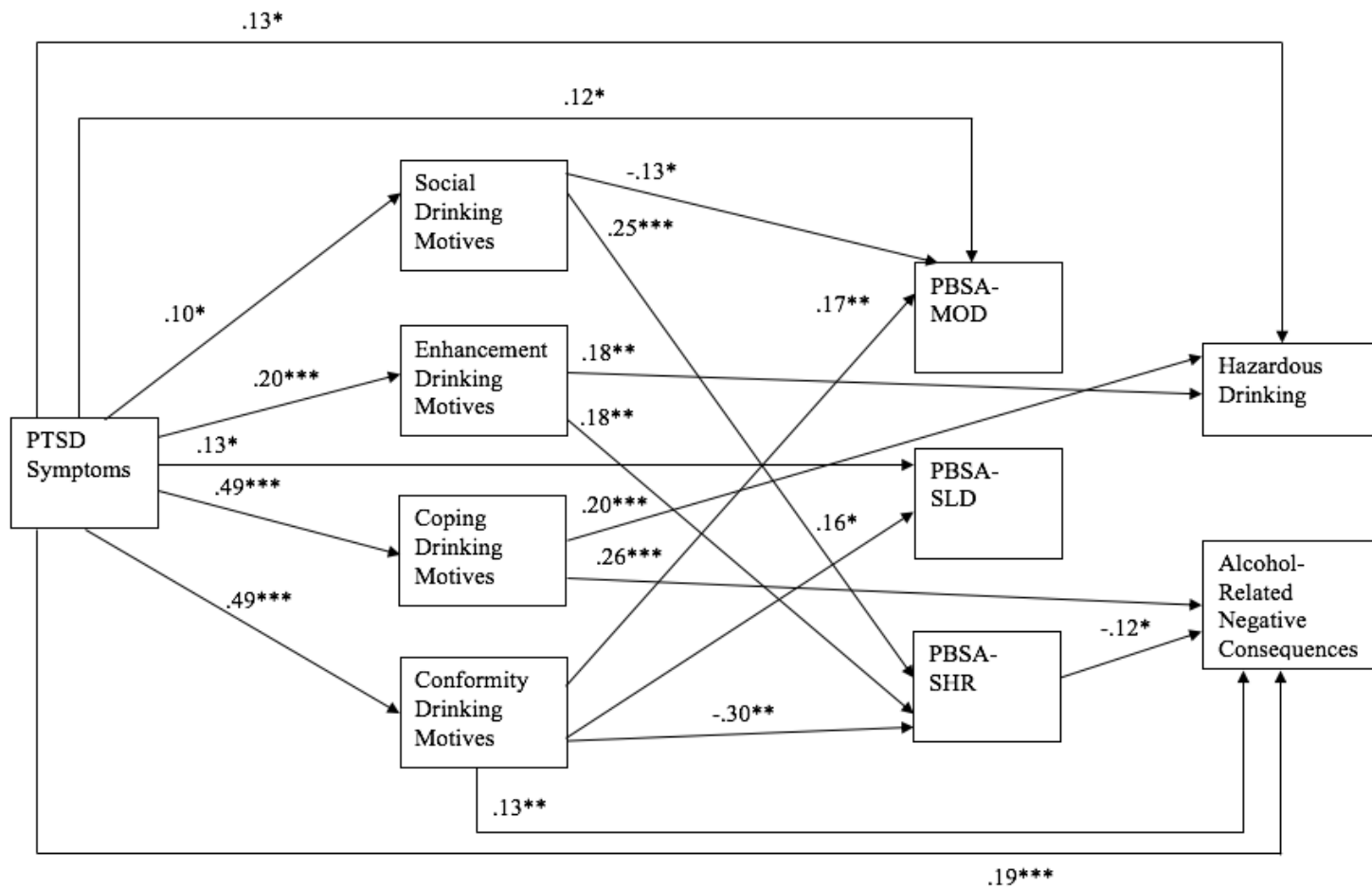


Figure 1. Significant paths within the mediation model.

$p < .001 = ***$, $p < .01 = **$, $p < .05 = *$

Contrary to hypothesis 1a, there were not significant sequential paths between coping drinking motives and PBSA-SLD ($\beta = .001$, 95% CI [-.002, .01]) or between coping drinking motives and PBSA-MOD ($\beta = .000$, 95% CI [-.003, .01]) in the overall relationship between posttraumatic stress symptoms and hazardous drinking. There were no significant relationships between coping drinking motives and PBS-SLD ($\beta = .06$, $p = .43$) or between coping drinking motives and PBSA-MOD ($\beta = .06$, $p = .312$), and neither PBSA-SLD ($\beta = .03$, $p = .65$) nor PBSA-MOD ($\beta = .002$, $p = .97$) predicted hazardous drinking. Also contrary to hypothesis 1a, there were not significant sequential paths between enhancement drinking motives and PBSA-SLD ($\beta = .000$, 95% CI [-.002, .001]) or between enhancement drinking motives and PBSA-MOD ($\beta = .000$, 95% CI [-.001, .002]) in the overall relationship between posttraumatic stress symptoms and hazardous drinking. Specifically, there were not significant relationships between enhancement drinking motives and PBSA-SLD ($\beta = -.01$, $p = .93$) or between enhancement drinking motives and PBSA-MOD ($\beta = .04$, $p = .51$).

Although hypothesized sequential mediations were not significant related to hypothesis 1a, sequential mediations that were not hypothesized to be significant emerged. Specifically, there were significant sequential mediations between social drinking motives and PBSA-SHR ($\beta = .002$, 95% CI [.000, .01], 0.64% mediated) and between enhancement drinking motives and PBSA-SHR ($\beta = .003$, 95% CI [.000, .01], 0.96% mediated). Specifically, posttraumatic stress symptoms predicted social drinking motives ($\beta = .10$, $p = .045$) and enhancement drinking motives ($\beta = .20$, $p < .001$). Further, social ($\beta = .25$, $p < .001$) and enhancement ($\beta = .18$, $p = .005$) drinking motives positively predicted PBSA-

SHR use. However, PBSA-SHR use did not significantly predict hazardous drinking ($\beta = .07, p = .162$). Also contrary to hypothesis 1a, social drinking motives and PBSA-SLD significantly mediated the relationship between posttraumatic stress symptoms and hazardous drinking ($\beta = .000, 95\% \text{ CI } [.000, .003], < .01\% \text{ mediated}$), such that posttraumatic stress symptoms and social drinking motives were positively associated; however, social drinking motives did not significantly predict PBSA-SLD use ($\beta = .08, p = .214$) and PBSA-SLD use did not significantly predict hazardous drinking. All significant paths in the mediation model are presented in Figure 1.

Alcohol-Related Negative Consequences

Consistent with hypothesis 1b, posttraumatic stress symptoms positively predicted ARNC ($c = .39, p < .001$; Figure 1). After accounting for the mediating roles of drinking motives and PBSA subtypes, the relationship was reduced but still significant ($c^I = .19, p < .001$), indicating a partial mediation. Consistent with hypothesis 1b, coping drinking motives ($\beta = .13, 95\% \text{ CI } [.08, .19]$) significantly mediated the relationship between posttraumatic stress symptoms and ARNC, as posttraumatic stress symptoms were positively associated with coping drinking motives ($\beta = .49, p < .001$) and coping drinking motives were positively associated with ARNC ($\beta = .26, p < .001$). Specifically, coping drinking motives mediated 33.51% of the relationship between posttraumatic stress symptoms and ARNC. Contrary to hypothesis 1b, conformity drinking motives also mediated the relationship between posttraumatic stress symptoms and ARNC ($\beta = .07, 95\% \text{ CI } [.01, .12]$), as posttraumatic stress symptoms were positively associated with conformity ($\beta = .49, p = .01$) drinking motives and conformity drinking motives were positively

associated with ARNC ($\beta = .13, p = .011$). This mediation accounted for 16.75% of the overall relationship between posttraumatic stress symptoms and ARNC. Also contrary to hypothesis 1b, enhancement drinking motives did not mediate this relationship ($\beta = .01, 95\% \text{ CI } [-.01, .04]$) as enhancement drinking motives were not associated with ARNC ($\beta = .06, p = .32$).

Inconsistent with hypothesis 1b, coping drinking motives and PBSA-SHR did not sequentially mediate the relationship between posttraumatic stress symptoms and ARNC ($\beta = .004, 95\% \text{ CI } [-.002, .02]$). Of note, PBSA-SHR and ARNC were significantly negatively associated ($\beta = -.12, p = .031$), but coping drinking motives and PBSA-SHR were not significantly associated ($\beta = -.07, p = .29$). Consistent with hypothesis 1b, enhancement drinking motives and PBSA-SHR sequentially mediated the relationship between posttraumatic stress symptoms and ARNC ($\beta = -.004, 95\% \text{ CI } [-.01, -.001]$), as posttraumatic stress symptoms positively predicted enhancement drinking motives, which in turn predicted PBSA-SHR use ($\beta = .18, p = .01$), with PBSA-SHR use predicting fewer ARNC ($\beta = -.12, p = .031$). This sequential mediation resulted in 1.03% of the overall relationship being accounted for. Contrary to hypothesis 1b, conformity drinking motives and PBSA-SHR sequentially mediated the relationship between posttraumatic stress symptoms and ARNC ($\beta = .02, 95\% \text{ CI } [.003, .04]$), as posttraumatic stress symptoms positively predicted conformity drinking motives, which were then negatively associated with PBSA-SHR use ($\beta = -.30, p < .001$), with PBSA-SHR use negatively predicting ARNC. 4.38% of the overall relationship between posttraumatic stress symptoms and ARNC was mediated by conformity drinking motives and PBSA-SHR. Consistent with

hypotheses, social drinking motives and PBSA-SHR ($\beta = -.003$, 95% CI [-.01, .000]) did not sequentially mediate the relationship between posttraumatic stress symptoms and ARNC.

Invariance Testing

To evaluate whether relationships were dependent on gender (hypothesis 2), invariance testing by gender was conducted in MPlus by comparing a fully constrained (by gender) and freely estimated model. When the model was freely estimated, five sequential mediation paths emerged as significant for one gender, but not the other (i.e. posttraumatic stress \rightarrow conformity \rightarrow PBSA-SHR \rightarrow ARNC, posttraumatic stress \rightarrow enhancement \rightarrow PBSA-SHR \rightarrow hazardous drinking, posttraumatic stress \rightarrow coping \rightarrow PBSA-MOD \rightarrow hazardous drinking, posttraumatic stress \rightarrow social \rightarrow PBSA-MOD \rightarrow hazardous drinking, posttraumatic stress \rightarrow conformity \rightarrow PBSA-SHR \rightarrow hazardous drinking). Thus, five additional models were run to separately constrain the specific paths of each of the abovementioned sequential mediation relationships. When each of these specific models were constrained, no meaningful differences emerged (where meaningful differences are indicated by a change in CFI of .01 or more from the freely estimated model to the constrained model; Chen, 2007). Changes in CFI are recorded in Table 5.

Table 5 *Invariance Testing Results by Gender.*

Model	CFI	ΔCFI Compared to Freely Estimated
Freely Estimated	1.000	
Gender		
Fully Constrained	.993	.007
PTSD → conformity → SHR → ARNC	1.000	.000
PTSD → enhancement → SHR → hazardous drinking	.998	.002
PTSD → coping → MOD → hazardous drinking	.999	.001
PTSD → social → MOD → hazardous drinking	1.000	.000
PTSD → conformity → SHR → hazardous drinking	.997	.003

Note. ARNC = alcohol-related negative consequences, PTSD = posttraumatic stress symptoms, SHR = serious harm reduction, MOD = manner of drinking.

No meaningful change in CFI of .01 or greater.

CHAPTER IV - DISCUSSION

The present study sought to examine the degree to which the relationships posttraumatic stress symptoms had with hazardous drinking and alcohol-related negative consequences were sequentially mediated by drinking motives and PBSA subtype use. Additionally, the study explored the extent to which these relationships were invariant by gender. Within the overall model including all variables, posttraumatic stress symptoms were positively associated with each of the four drinking motives, PBSA involving manner of drinking and stopping/limiting drinking, hazardous drinking, and alcohol-related negative consequences. These findings are consistent with an established literature demonstrating the positive association between posttraumatic stress symptoms and alcohol-related outcomes, including hazardous drinking and alcohol-related negative consequences (e.g., Berenz et al., 2016; Jordan et al., 2019; Kaysen et al., 2013; Tripp et al., 2015). Although some studies have found posttraumatic stress symptoms to be related to specific drinking motives, such as coping (e.g., Aarstad-Martin & Boyraz, 2017) or enhancement (e.g., Lehavot et al., 2014), the present findings corroborate existing research showing posttraumatic stress symptoms can be associated with each of the four drinking motives (Hawn et al., 2018; Nugent et al., 2012). Although positive associations emerged between posttraumatic stress symptoms and each of the four drinking motives, analyses were not conducted to compare the relative strength of each association.

The hypothesis that the relationship between posttraumatic stress symptoms and hazardous drinking would be sequentially mediated by coping and enhancement drinking motives as well as PBSA involving manner of drinking and stopping/limiting drinking was partially supported. Specifically, the relationship between posttraumatic stress

symptoms and hazardous drinking was mediated by coping drinking motives, but PBSA subtypes (i.e. manner of drinking PBSA; stopping/limiting drinking PBSA) did not emerge as significant elements of the model, contrary to predictions. The same pattern emerged when evaluating enhancement drinking motives as a mediator. While the explanatory roles of coping and enhancement motives are consistent with past research (e.g., Aarstad-Martin & Boyraz, 2017; Simpson et al., 2014), one reason why manner of drinking and stopping/limiting drinking PBSA did not emerge as significant factors in the model may lie in the separated measurement of these controlled consumption PBSA (Madson et al., 2013a). Specifically, Villarosa and colleagues (2018) found coping and controlled consumption PBSA (manner of drinking and stopping/limiting drinking PBSA combined) explained the relationship between depressive symptoms and hazardous drinking. Perhaps separate measurement of manner of drinking and stopping/limiting drinking PBSA rather than a combined subscale in the present study minimizes the collective benefit of these types of strategies focused on changing hazardous drinking. It could be that students are choosing a minimal number of each type of strategy (i.e. how they drink and limits on their drinking), and thus when they are collapsed in one scale the impact can be detected, but when they are split it cannot. Further, drinking to cope motives can be split into drinking to cope with anxiety and drinking to cope with depression motives (Grant, Stewart, O'Conner, Blackwell, & Conrad, 2007), which is how Villarosa and colleagues measured coping drinking motives (2018). However, the present study was primarily interested in a global assessment of coping drinking motives as it was the first to examine these relationships with posttraumatic stress symptoms, drinking motives, and PBSA, which is why the analyses evaluated a combined drinking

to cope subscale. But, perhaps there are unique relationships between the different types of coping drinking motives and subsequent PBSA use in the context of posttraumatic stress symptoms.

Furthermore, using manner of drinking or stopping/limiting drinking PBSA may not be relevant for students depending on their drinking context. For example, if these students with posttraumatic stress symptoms are drinking in isolation to cope with their symptoms, some of the strategies may be futile as they are aimed towards more social or party settings (e.g., avoiding drinking games, avoiding pregaming). Additionally, if the individual is using alcohol to cope with or enhance mood, they may not be particularly motivated to use any of the PBSA as that could be perceived as interfering with their desired outcome from drinking. When examining bivariate correlations, posttraumatic stress symptoms were positively associated with manner of drinking and stopping/limiting drinking PBSA, but not serious harm reduction PBSA. This contrasts with findings by Villarosa and colleagues (2018) who found that another mental health concern, increased depressive symptoms, were associated with less use of strategies aimed to control consumption and less use of serious harm reduction PBSA. However, Jordan and colleagues (2018) found general psychological distress was positively associated with PBSA focused on controlling consumption, consistent with the present study's findings that posttraumatic stress symptoms were associated with greater manner of drinking and stopping/limiting drinking PBSA. One explanation for the present positive association posttraumatic stress symptoms had with manner of drinking and stopping/limiting drinking PBSA use may be that individuals with these symptoms perceive it as important to engage in harm reduction strategies when consuming alcohol

to either reduce overall alcohol consumption, reduce alcohol-related negative consequences through reduced alcohol consumption. Another important point to note is that manner of drinking and stopping/limiting drinking PBSA were positively correlated with hazardous drinking, which is inconsistent with much of the literature (e.g., Pearson, 2013). This could be a product of measurement error, as studies like Villarosa and colleagues' (2018) used the full version of the AUDIT-US (i.e. 10 items) that includes an assessment of consequences rather than the abbreviated three item AUDIT-US-C that assess frequency and quality of alcohol use only.

In the context of this hypothesis that the relationship between posttraumatic stress symptoms and hazardous drinking would be sequentially mediated by coping and enhancement drinking motives as well as manner of drinking and stopping/limiting drinking PBSA use, several non-hypothesized relationships emerged. Social drinking motives and serious harm reduction PBSA, as well as enhancement drinking motives and serious harm reduction PBSA, appeared to partially explain the relationship between posttraumatic stress symptoms and hazardous drinking. Yet, although posttraumatic stress symptoms positively predicted social and enhancement drinking motives, and each of these drinking motives positively predicted serious harm reduction PBSA use, such use did not actually predict hazardous drinking. This is consistent with literature demonstrating serious harm reduction PBSA has a more potent impact on alcohol-related negative consequences and does not tend to have much of a protective effect on hazardous drinking (e.g., Pearson, 2013). When considering the links between social and enhancement drinking motives with serious harm reduction PBSA use, perhaps these motives with positive valence are helpful in promoting the use of serious harm reduction

PBSA. In other words, harm reduction strategies not specific to alcohol consumption could be viewed as a way to have fun and drink for positive social and mood enhancement benefits while minimizing the negative elements of drinking that might interfere with the positive desired outcomes. In turn, those motives may be promoting serious harm reduction PBSA use because such use may be viewed as facilitating the achievement of their drinking motives without introducing negative elements to the drinking experience.

Additionally, social drinking motives and stopping/limiting drinking PBSA appeared to partially explain the posttraumatic stress and hazardous drinking relationship. It could be that individuals high in social drinking motives with posttraumatic stress symptoms view stopping/limiting drinking PBSA as a way to help them achieve their drinking motive (e.g., it could be embarrassing to become overly intoxicated, so moderating their drinking could ensure they achieve the social benefits of drinking without sabotaging this through too much drinking). Despite the significant partial mediation, the paths between social drinking motives and stopping/limiting drinking PBSA and then between stopping/limiting drinking PBSA and hazardous drinking did not emerge as significant. When considering the lack of association between PBSA-SLD and hazardous drinking, perhaps individuals in the present sample placed limits on their drinking, but these limits were still high and thus ensuing alcohol consumption would still be considered hazardous.

The hypothesis that the relationship between posttraumatic stress symptoms and alcohol-related negative consequences would be sequentially mediated by coping and enhancement drinking motives as well as serious harm reduction PBSA was partially

supported. Consistent with Aarstad-Martin & Boyraz (2017), coping drinking motives mediated the relationship between posttraumatic stress symptoms and alcohol-related negative consequences. This is consistent with the self-medication hypothesis in that individuals experiencing greater symptomatology may use substances as a way to alleviate the experience of those symptoms and as a result experience more associated consequences (Haller & Chassin, 2014), and with increased substance use. However, the hypothesized relationship between posttraumatic stress symptoms, coping drinking motives, serious harm reduction PBSA, and alcohol-related negative consequences was not significant. One reason may be that individuals who are using substances are focused primarily on the relieving of distress, and any action that could be viewed as a barrier to that (e.g., protective steps while drinking) is avoided. Alternatively, if an individual is drinking to cope, perhaps they are drinking at home in isolative environments, again rendering many of the serious harm reduction PBSA (e.g., designated driver, watching your drink, leaving with a friend) useless as those these strategies assume a party or social-type setting. Yet another explanation could lie in the posttraumatic stress symptom profile, as one symptom is “taking too many risks or doing things that could cause you harm?” (APA, 2013; Weathers et al., 2013). Individuals with posttraumatic stress symptoms may not engage in protective strategies as a result of symptoms in which an individual increases risk-taking or harm-related behaviors, and in turn reduces their engagement in harm reduction behaviors.

Consistent with hypotheses, enhancement drinking motives and serious harm reduction PBSA partially explained the relationship between posttraumatic stress symptoms and alcohol-related negative consequences. This is consistent with the findings

that PBSA explained the association between positive drinking motives (including enhancement) and alcohol-related negative consequences (Ebersole et al., 2012; Martens et al., 2007). However, the nuances of the relationship (i.e. that enhancement motives predicted increases in serious harm reduction PBSA) are inconsistent with Ebersole and colleagues' (2012) finding that PBSA mediated the relationship between enhancement and consequences through less PBSA use. In the present study, the positive relationship between enhancement and serious harm reduction PBSA may exist because individuals who are drinking to promote their mood perceive using PBSA as a way that helps facilitate their outcome, rather than hinder it. For instance, using these strategies may help prevent a negative experience from happening, as a negative experience would likely decrease the positive mood effects they are seeking from alcohol use. An alternative explanation may lie in the sample, as Ebersole and colleagues (2012) examined the relationship in a sample of Lesbian, Gay, and Bisexual students and did not assess for mental health symptoms. Perhaps the nature of the present sample being high in posttraumatic stress symptoms captures a motivation to use serious harm reduction PBSA when drinking to enhance their mood because they see the strategies as helping prevent them from activating or worsening their posttraumatic stress symptoms through avoiding a consequence that could be potentially traumatic again.

Although not hypothesized, the positive relationship between posttraumatic stress symptoms and alcohol-related negative consequences was also significantly mediated by conformity drinking motives and serious harm reduction PBSA. One reason for this relationship could be understood through the way conformity drinking motives predicted less serious harm reduction PBSA use. Given the nature of conformity drinking motives

(i.e. drinking to fit in; Cooper, 1994), maybe college students with posttraumatic stress symptoms view using serious harm reduction PBSA as a potential threat to fitting in with others while drinking if use of these strategies is not viewed as a normative behavior. Consistent with previous research, more serious harm reduction PBSA use was then in turn associated with less alcohol-related negative consequences (e.g., Villarosa et al., 2014). Finally, when considering reasons why only certain motives emerged as significant mediators, it may be that when posttraumatic stress symptoms are more activated or heightened, certain drinking motives become more salient (i.e. coping, enhancement) given the self-medication hypothesis (Maisto et al., 2012). However, as the present study measured only the presence of posttraumatic stress symptoms at one time, it is not possible to elucidate from these data whether drinking motives change in tandem with fluctuations in posttraumatic stress symptom salience.

The hypothesis that these relationships would vary by gender was not supported as the sequentially mediating effects of drinking motives and PBSA on the relationship between posttraumatic stress symptoms and alcohol outcomes did not vary by gender. This is inconsistent with myriad studies demonstrating gender differences across many variables of interest in the present study (e.g., drinking motives, PBSA use, alcohol-related outcomes; e.g., Lehavot et al., 2014; Jordan et al., 2018). However, data show the gender gap in alcohol consumption behaviors for college students is narrowing (Krieger, Young, Anthenien, & Neighbors, 2018). Although Jordan and colleagues (2018) found the moderating roles of PBSA on the posttraumatic stress symptom and alcohol-related negative consequences relationship did vary in strength based on gender, perhaps those findings were driven by the larger proportion of females in the sample (i.e. greater than

70%), whereas the present sample had virtually even proportions of men and women. Perhaps some of these gender differences that have emerged are products of sampling error that come with an over-representation of one group (in this case, women) in the sample relative to the actual population, potentially as a product of obtaining local convenience samples at selected universities across the country rather than allowing for participants from any college or university in the United States. Essentially, as this sample consists of a relatively even sample of men and women, it could be that it is accurately capturing a lack of gender differences at present in how drinking motives and PBSA use interact with alcohol consumption behaviors and outcomes for college students with posttraumatic stress symptoms. Another explanation may be that gender norm adherence, rather than gender identification or biological sex, is a driving force behind alcohol-related gender differences (Miller, Whitley, Scully, Madson, & Zeigler-Hill, 2019).

Clinicians working with college students reporting posttraumatic stress symptoms and alcohol consumption should assess both their drinking motives and their current use of PBSA. Interventions should focus on helping the student identify and implement alternative means to achieve their desired outcomes for drinking, particularly if their drinking is resulting in elevated hazardous levels and/or alcohol-related negative consequences. A specific intervention strategy could be for clinicians to help their clients determine which PBSA may not interfere with their desired drinking motive but could still alleviate potentially hazardous drinking or alcohol-related negative consequences, and then focus on the implementation of those specific strategies to still achieve their desired outcome while reducing harm. On a widespread prevention effort, campaigns

with messages on how to cope with difficulties in healthy, non-substance focused ways could be promoted, particularly as rising mental health concerns and general stress on college campuses increases (Liu, Stevens, Wong, Yasui, & Chen, 2018). For example, talks and workshops could be provided during student orientations or even classes that would otherwise be cancelled due to instructor absences that focus on healthy coping strategies

Generally, these results provide support for ensuring college students have access to clinicians trained in evidence-based PTSD treatment (e.g., Cognitive Processing Therapy, Prolonged Exposure; APA, 2017). Following the self-medication hypothesis (e.g., Maisto et al., 2012), if the cause of the symptoms can be treated, then the self-medication behaviors (i.e. harmful substance use) are likely to significantly decrease. This is consistent with what is seen in the treatment of co-occurring mental health and substance use problems – treating one helps the other (McCauley, Killeen, Gros, Brady, & Back, 2012). Thus, providing sound evidence-based treatment for problems co-occurring with problematic substance use is an essential intervention to have available to help these students. To identify who may benefit from evidence-based treatment of co-occurring traumatic stress and substance use problems, these findings highlight a need for counseling centers and clinicians working with college students to conduct assessments of mental health symptoms and substance use behaviors.

Despite study strengths such as national sample, there are several notable limitations. First, this was a cross-sectional design which does not allow for causal inferences. Ecological momentary assessment tools could be used to assess symptom endorsement, subsequent motivations for drinking, resulting PBSA use, and actual

alcohol-related outcomes to begin establishing temporal precedence among these constructs in order to make more causal claims. Additionally, while the sample appears generalizable in terms of gender and geographic location, there may be something unique about MTurk users compared to the overall college population. It would be important to compare models between samples of MTurk users and general college students who deny MTurk participation to evaluate if models can be invariant between the two. This will be an important step of contributing to our knowledge of how MTurk users can be valid or not valid subjects.

Another limitation of the study is that it did not account for other substance use, including co-use or simultaneous use, particularly of marijuana given its prevalence among college students (SAMHSA, 2015; Schulenberg et al., 2019). Future research should test these relationships accounting for the use of other substances, as perhaps students are self-medicating with multiple substances including alcohol, or substances that are not alcohol. It would also be important to evaluate whether similar relationships exist when examining motivations and protective strategies relevant for those specific other substances (e.g., marijuana).

Finally, although this study used the Life Events Checklist to evaluate whether a participant experienced a potentially traumatic event, and they were instructed to identify and keep their worst event in mind when completing the PCL-5, it is difficult to ensure the reporting of posttraumatic stress symptoms was specific to that event and not relative to another event or generalized to stress overall that was not event-specific. Future research should consider using more thorough assessments of posttraumatic stress symptoms rather than screening measures to identify these symptoms (Jordan et al.,

2018). Future studies should examine how drinking motives impact students' decisions to use PBSA. Additionally, it is important to understand how these relationships are similar for students with other mental health problems (e.g., social anxiety, general anxiety) beyond posttraumatic stress disorder and depression (Villarosa et al., 2018). Also, the present study assessed posttraumatic stress symptoms occurring over the past month related to one's worst event using the PCL-5, which does not account for the presence of more complex forms of traumatic stress, including posttraumatic stress symptoms lasting for significantly longer or in response to multiple traumas.

To the best of my knowledge, this is the first study to examine the relationships between posttraumatic stress symptoms, drinking motives, PBSA use, and alcohol-related outcomes in a national sample of college students. Given the rates of posttraumatic stress symptoms coupled with the prevalence of alcohol consumption and alcohol-related negative consequences on college campuses, it is imperative to better understand factors which worsen alcohol-related outcomes as well as factors which are protective for these students who are drinking. Better understanding risk factors highlights important screening and intervention targets, and identifying harm reduction or protective factors sheds light on potential intervention content. Overall, this study highlights the ways drinking motives and PBSA help explain the relationships between posttraumatic stress symptoms and alcohol-related outcomes and that these relationships do not vary by gender.

APPENDIX A - IRB APPROVAL LETTER



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NOTICE OF COMMITTEE ACTION

The project below has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services regulations (45 CFR Part 46), and University Policy to ensure:

- The risks to subjects are minimized and reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered involving risks to subjects must be reported immediately, but not later than 10 days following the event. Problems should be reported to ORI via the Incident template on Cayuse IRB.
- The period of approval is twelve months. An application for renewal must be submitted for projects exceeding twelve months.

PROTOCOL NUMBER: IRB-18-143

PROJECT TITLE: Thoughts, Behaviors, and Substance Use Outcomes among College Students

SCHOOL/PROGRAM: School of Psychology, Psychology

RESEARCHER(S): Hallie Jordan

Michael Madson

IRB COMMITTEE ACTION: Approved

CATEGORY: Exempt

PERIOD OF APPROVAL: January 7, 2019 - January 8, 2020

Edward L. Goshorn, Ph.D.
Institutional Review Board Chairperson

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