Unraveling the Relationships between PTSD and Alcohol Use Among College Students: A Multi-method Examination

Zannie L. Montgomery

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Psychological Sciences Department

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APPROVAL PAGE

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Zannie L. Montgomery

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Committee Chair
Adrian J. Bravo, Assistant Professor, Psychological Sciences
College of William & Mary

Cheryl L. Dickter, Professor and Director of Graduate Studies, Psychological Sciences
College of William & Mary

Joshua A. Burk, Professor, Psychological Sciences
College of William & Mary

COMPLIANCE PAGE

Research approved by:

William and Mary

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ABSTRACT

Present Study. The present studies examined the relationships between PTSD, autobiographical memory, attitudes toward self (ATS), alcohol quantity, and negative alcohol consequences. Prior research has indicated that attitudes ATS may not only be linked to the development of PTSD symptoms (Brewin et al., 2000) but also increased use (Annis, 1982) and alcohol consequences. Regarding autobiographical memory, research has indicated that autobiographical memories may lead to increased alcohol use as well (Jaffe et al., 2019). In Study 1 participants were college students (N = 4,635, 87.8% female) recruited from Psychology Department participant pools (SONA) at six universities across five U.S. states and the District of Columbia to participate in an online survey on substance use behaviors lasting approximately one hour. Results for Study 1 indicated that high standards (a component of ATS) uniquely significantly mediated the association between PTSD and alcohol quantity, such that higher PTSD symptoms were associated with higher standards, which in turn was associated with less alcohol quantity. Regarding negative alcohol consequences, our results found that overgeneralization (a component of ATS) uniquely mediated the relationship between PTSD and alcohol consequences, such the greater endorsement of PTSD symptoms was associated with more overgeneralization, which in turn was associated more negative alcohol related consequences. Within our moderation model focused on autobiographical memory, autobiographical memory nor its interaction with PTSD were significantly associated with alcohol consequences or quantity. In Study 2, we sought to further examine the associations between PTSD, autobiographical memory, and ATS by utilizing a mindfulness induction amongst a localized sample of participants to decrease alcohol craving. We found no significant experimental effects on ATS and autobiographical memory components. However, there was a significant interaction observed in subjective alcohol craving, such that individuals randomized to the mindfulness condition reported greater reduced craving for alcohol compared to those in the control condition. This significant finding was held even when accounting for probable PTSD. *Conclusions.* Study 1 revealed that ATS, specifically high standards and overgeneralization are important to consider when examining factors that mediate the relationship between individuals with PTSD and alcohol quantity and consequences. Study 2 revealed that the mindfulness induction decreases subjective alcohol craving among those randomized to the mindfulness condition. Taken together, further exploration of additional variables and measurement techniques are needed to provide a more comprehensive understanding of the interplay between these associations. Nonetheless, our findings offer insight into novel ways in which researchers/clinicians can enhance the effectiveness of interventions and improve outcomes for college students who may be struggling with substance use and PTSD.

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Unraveling the Relationships between PTSD and Alcohol Use Among College Students: A Multi-method Examination

Excessive alcohol consumption can have harmful health effects on college students, including cognitive impairments, an increased chance of physical assault, and even mortality (Hingson et al., 2009; White & Hingson, 2013). Despite these negative consequences, about 45% of college students report heavy episodic drinking in the previous month (Hua et al., 2022). Given such risky behaviors, it is important to identify factors that both alleviate these effects such as protective risk factors (i.e., social support, mindfulness; Haliwa et al., 2022) as well as any factors that may exacerbate these effects such as Post-Traumatic Stress Disorder (PTSD). Prior research suggests that college students face many traumas, including but not limited to, natural disasters, military trauma, life-threatening illnesses, car accidents, sexual assault, and other forms of interpersonal violence (Read et al., 2011; Ullman & Filipas, 2005). Moreover, reported prevalence of PTSD among college students ranges from 2.7 to 66.7% (Tang et al., 2020; Abdel-Aziz et al., 2022). Regarding alcohol, prior research demonstrates that college students who have experienced trauma are more likely (compared to those who have not) to drink heavily and experience unfavorable alcohol-related consequences (Anthenelli et al., 2018; Read et al., 2015). Moreover, research suggests that students with PTSD display more risky patterns of substance abuse than other students, even those who met the criteria for other disorders (McDevitt-Murphy et al., 2010). Given such high comorbidity,

research identifying mechanisms linking PTSD to alcohol outcomes and protective factors that buffer this relationship is of great importance as well.

PTSD, Attitude Towards Self, and College Student Drinking

Research suggests that individuals with lower self-esteem, negative self-concept, or negative self-perception may be more vulnerable to developing and maintaining PTSD symptoms (Brewin et al., 2000; Pietrzak et al., 2009). According to the modern cognitive paradigm (Ehlers & Clark, 2000), there are two main processes that contribute to chronic PTSD: excessively negative appraisals of traumatic events and/or their consequences and fragmented autobiographical memory. Assessments regarding a person's important internal norms being violated might cause them to feel threatened and ultimately ashamed, but assessments about their own accountability for a traumatic incident and/or its aftermath can cause them to feel guilty (Ehlers & Clark, 2000; Lawrence & Taft, 2013). A substantial and expanding corpus of literature has investigated the connections between guilt, shame and PTSD. Although shame has yielded more conflicting results than guilt, both feelings have been linked to the intensity of PTSD symptoms and the success of treatment. In fact, the most prevalent post-treatment residual symptom of PTSD is negative self-referent cognitions (Cunningham, 2020). Regarding college student drinking, studies have found that negative self-beliefs and self-perceptions can contribute to patterns of heavy drinking and alcohol-related problems (Annis, 1982; Jones et al., 2001). College students who have negative self-views may engage in excessive alcohol consumption as a form of self-medication or coping strategy

(Martins et al., 2008). While the specific relationship between PTSD, attitudes toward self (ATS), and college student drinking needs further exploration, it is plausible that a negative self-attitude could mediate the relationship between PTSD symptoms and alcohol outcomes. Specifically, individuals reporting greater PTSD symptoms may report greater negative self-perceptions (i.e., lower ATS), which may result in problematic drinking as a means of coping with negative emotions or self-image tied to their prior trauma.

Memory, PTSD, and College Student Drinking

Research suggests that there is a significant link between autobiographical memory, PTSD, and college student drinking. Autobiographical memory refers to the ability to recall personal memories and experiences (Berntsen & Rubin, 2012). Autobiographical memory is made up of multiple cognitive and affective components that must come together to generate unique memories. It can also be impacted by other elements like personality and medical conditions (Berntsen et al., 2019). Another important aspect of autobiographical memory is individual differences. Certain studies have revealed that differences in autobiographical memory can occur across genders (Andreano & Cahill, 2009), as women may be more likely to recall personal events than men. Some studies have even shown age differences with subjective ratings for autobiographical memory increasing being higher with age (Rubin & Berntsen, 2009). Also, some individuals can effortlessly retrieve memories (LePort et al., 2012), whereas others may lack the ability to do so (Palombo et al., 2015).

Ehler's and Clark's (2000) modern cognitive paradigm proposes that the memory of the traumatic experience is incompletely elaborated, not fully contextualized in terms of time and location, and not fully integrated with other autobiographical knowledge and memories, which constitutes the second source of current threat in PTSD. Specifically, the theory posits that the worst parts of the trauma are disconnected from earlier and later information in memory that is crucial for understanding the significance of the incident. This is particularly pertinent to the explanation of reliving symptoms (Ehlers et al., 2004). Further, research suggests that memory recall and retrieval issues may be particularly vulnerable to trauma-related disorders, such as PTSD (Harvey & Bryant 2000; Nahleen et al., 2019). Studies indicate that individuals with PTSD often experience difficulties in retrieving and integrating autobiographical memories, which can contribute to the development and maintenance of PTSD symptoms (Hauer et al., 2009). These recall and retrieval issues therefore contribute to what is known as over general autobiographical memory (OGM). The incapacity to recall specific memories from one's autobiographical memory for events that took place at a certain location and time and lasted less than a day is a defining characteristic of OGM (Williams & Broadbent, 1986). According to Erten and Brown (2018), certain autobiographical memories' roles in emotion regulation, decision-making, and social support may contribute to the role of OGM in PTSD (Bluck et al., 2005). For instance, a person's capacity to interpret, (re-)evaluate, self-regulate, and react to new stressors may be enhanced by remembering comparable specific situations. Furthermore, because autobiographical

memories are associated with social bonding, people who struggle to retrieve autobiographical memories may also find it challenging to establish and sustain social support networks (Bluck et al., 2005). In addition, deficiencies in autobiographical memory specificity seem to sustain maladaptive cognitive processes including rumination, avoidance of unpleasant memories, and pessimism that are frequently seen in PTSD (see Raes et al., 2009 for an overview).

Focusing on alcohol, autobiographical memory difficulties, such as fragmented or intrusive memories, can trigger distress and lead individuals to engage in alcohol use to cope with the emotional impact of traumatic memories (Jaffe et al., 2019). Taken together, understanding the moderating effects of autobiographical memory on the relationship between PTSD and college student drinking is crucial for developing effective interventions targeting both PTSD symptoms and hazardous alcohol consumption.

Purpose of Present Studies

The aims of the present studies were to expand upon the existing relationship between PTSD and alcohol by examining other factors that may impact the association between PTSD and alcohol use outcomes within the college student population. The present study addressed these aims through two independent studies. The first study examined the relationships between PTSD symptoms, ATS, autobiographical memory, and alcohol use outcomes (i.e., quantity and negative consequences) via a multi-site cross-sectional survey study. The second study was an experimental study in which we examined the

impact that mindfulness induction has on the relationship between PTSD, ATS, autobiographical memory, and alcohol craving.

Study One

Based on previous research, ATS and autobiographical memory may be important factors to consider when examining the relationship between PTSD and alcohol consumption within the college student population. For the present study, we examined ATS as a mediator and autobiographical memory as a moderator of the relationship between PTSD symptoms and alcohol outcomes (i.e., use quantity and negative consequences). Based on the modern cognitive paradigm (Ehlers & Clark, 2000), we hypothesized that ATS would significantly mediate the relationship between PTSD and alcohol outcomes. Specifically, individuals reporting greater PTSD symptoms will report greater negative self-perceptions (i.e., lower ATS), and in turn lower ATS will be associated with greater alcohol use quantity and negative alcohol consequences. Regarding autobiographical memory, we hypothesized that autobiographical memory would moderate the associations between PTSD symptoms and alcohol outcomes such that it would weaken the relationship between PTSD symptoms and both alcohol use quantity and negative alcohol consequences.

Study One Methods

Participants and Procedures

We recruited college students (N = 4,635) from Psychology Department participant pools (SONA) at six universities across five U.S. states and the District of Columbia to participate in an online survey lasting approximately one

hour on substance use behaviors.Participants received research credit or extra credit for their participation. This protocol was approved by institutional review boards at each participating university (either independently or via a multi-site institutional review board). For this study, the analytic sample was limited to students who consumed alcohol in the past 30 days and reported experiencing at least one traumatic event in their lifetime. All 376 students completed questionnaires concerning PTSD symptoms, ATS, autobiographical memory, alcohol quantity, and negative alcohol consequences. Our participants primarily identified as being White (89.1%), female (87.8%), and reported a mean age of 19.23 years (Median= 19.00; SD=1.34) years. In addition, nearly half (44.7%) of our analytic sample reported being in their first year in college.

Measures

PTSD Symptoms. The PTSD Checklist for DSM-5 (PCL-5; Blevins et al., 2015) was used to measure PTSD symptoms within the previous month. The PCL-5 is a 20-item test that evaluates PTSD symptoms on a 5-point Likert scale (0 = "*not at all"*, 4 = "*excessively"*). All items were summed for the current study's purposes, representing the overall traumatic stress symptoms. The cut-off for likely PTSD is a score of 33 or above (Blevins et al., 2015), and within our analytic sample, approximately 55% of participants exceeded the cutoff for probable PTSD (α = .97).

Attitudes Toward Self (ATS). The Attitudes Toward Self-Revised (ATS-R; Carver et al., 1998) scale was used to measure attitudes toward self. The ATS-R is a 10-item scale that evaluates attitudes toward self on a 5-point Likert

scale (1= "*I agree very strongly*", 5= "*I disagree very strongly*"). It includes a 3-item scale assessing overly High Standards (e.g., "I set higher goals for myself than other people seem to") (α = .82), a 3-item scale assessing Self-Criticism (α = .82) (e.g., "When I don't do as well as I hoped to, I often get upset with myself"), and a 4-item scale assessing Over Generalization (e.g., "A single failure can change me from feeling OK to seeing only the bad in myself") (α = .79). Similar to prior research (Fulford et al., 2012), responses for each subscale were averaged (and reverse-coded if needed), with higher scores indicating higher endorsement of the scale.

Autobiographical Memory: The Brief Autobiographical Recollection Test was used to measure autobiographical memory (Brief ART; Berntsen et al., 2019). The Brief ART is a 7-item measure that evaluates the properties of each nominated memory using a 7-point Likert scale (1= "*Strongly Disagree*", 7= "*Strongly Agree*"). The Brief ART measures the following seven properties: reliving (e.g., "While remembering past events, it is as if I am reliving them"), vividness (e.g., "My memories of past events have lots of details"), visual imagery (e.g., "While remembering past events, I can see them in my mind") , scene (e.g., "In my memories of past events, I remember where the actions, objects, and people are located in the events"), narrative coherence (e.g., "My memories of past events come to me as good stories or descriptions"), life story relevance (e.g., "My memories of past events are a central part of my life story"), and rehearsal (e.g., "I often think back to past events in my mind and think or talk about them"). Similar to prior research (Gehrt et al., 2022), all items were

averaged with higher scores indicating higher endorsement of autobiographical memory (α = .84). Prior to completing this measure, participants were instructed to think of one prior traumatic event and respond to questions from this measure with that prior event in mind.

Alcohol Use. A modified version of the Daily Drinking Questionnaire (Collins et al., 1985) was used to measure typical alcohol quantity. To measure typical quantity of alcohol use per week, participants were presented with a visual guide about typical drinks to help them ascertain the concept of Standard Drink Units (SDUs). Using a grid such that each day of the week was broken down into six 4-hour blocks of time (12a-4a, 4a-8a, 8a-12p, etc.), participants were asked to report at which times they consumed alcohol during a "typical week" in the past 30 days, as well as the number of drinks typically consumed during that time block. Typical alcohol use quantity was calculated by summing the total number of standard drinks consumed across time blocks during the typical week (quantity estimates >3SDs above the mean were Winsorized to the 3SD value).

Alcohol Use Consequences. The Brief-Young Adult Alcohol Consequences Questionnaire (B-YAACQ; Kahler et al., 2005) was used to assess negative alcohol-related problems. The B-YAACQ is a 24-item questionnaire, adapted from the 48 item Young Adult Alcohol Consequences Questionnaire (Read et al., 2006) that measures alcohol-related negative experiences within the past 30 days (e.g., "I have often found it difficult to limit how much I drink", "When drinking, I have done impulsive things that I regretted later"). Participants were instructed to respond to statements regarding alcohol

use consequences with “Yes” for the items they endorsed in the last 30-days and “No” for items they did not endorse in the last 30-days. A composite score reflective of the total number of distinct alcohol problems experienced in the past 30 days was created by summing all endorsed experiences (α = .88).

Analyses Plan

To address Study 1 aims, bivariate correlations were estimated to examine the independent associations between PTSD, ATS subscales, autobiographical memory, and alcohol use outcomes (alcohol typical quantity, alcohol consequences). Two simple mediation models were estimated using model 4 of the PROCESS 4.1 macro (Hayes, 2017) for SPSS to test whether the differing ATS subscales (e.g., high standards, self-criticism, generalization) were distinct mechanisms through which PTSD symptoms related to the alcohol outcomes (alcohol typical quantity, alcohol consequences). Two simple moderation analyses were estimated using model 1 of the PROCESS 4.1 macro (Hayes, 2017) for SPSS to test whether the relationship between PTSD and the alcohol use outcomes (alcohol typical quantity and alcohol consequences) varies depending on whether an individual endorses higher autobiographical memory. Variables were standardized to produce standardized regression coefficients. Gender was controlled for in all analyses and typical quantity was estimated as a covariate when examining negative alcohol-related consequences as an outcome. Statistical significance was determined by 95% percentile-based confidence interval (based on 10,000 bootstrapped samples) that did not contain zero. Significant interaction terms were interpreted by plotting predicted outcome

values and conditional effects (provided by PROCESS) at levels of the moderator (i.e., 1 SD below the mean, the mean, and 1 SD above the mean) as recommended by Cohen and colleagues (2003).

Study One Results

Descriptive statistics and correlations of all study variables are presented in Table 1. Negative alcohol-related consequences were significantly positively associated with alcohol quantity, PTSD, overgeneralization, and autobiographical memory. Alcohol quantity was significantly negatively associated with high standards. PTSD symptoms were significantly positively associated with high standards, overgeneralization, self-criticism, and autobiographical memory.

Mediation Results

Alcohol Quantity. Within our alcohol quantity mediation model (see Table 2 and Figure 1), PTSD was significantly associated with high standards (β = .14, 95% CI [.04, .25]), overgeneralization (β = .25, 95% CI [.15, .35]), and self-criticism (β = .19, 95% CI [.10, .30]). Neither overgeneralization (β = -.03, 95% CI [-.15, .09]) nor self-criticism (β = .10, 95% CI [-.04, .26]) were significantly directly associated with alcohol quantity. Taken together, overgeneralization (indirect β = -.01, 95% CI [-.04, .02]) nor self-criticism (indirect β = .02, 95% CI [-.01, .06]) significantly mediated the association between PTSD and alcohol quantity. However, we did observe that high standards were significantly directly associated with alcohol quantity (β = -.18, 95% CI [-.30, -.06]) and uniquely mediated the association between PTSD and alcohol quantity (indirect β = -.03,

95% CI [-.06, -.003]), such that PTSD symptoms were associated with higher standards, which in turn was associated with less alcohol quantity.

Negative Alcohol Consequences. Within our negative alcohol consequences mediation model (see Table 2 and Figure 2), PTSD was significantly associated with the high standards (β = .16, 95% CI [.06, .26]), overgeneralization (β = .25, 95% CI [.16, .35]), and self-criticism (β = .20, 95% CI [.10, .30]). Two of the ATS subscales: high standards (β = -.03, 95% CI [-.16, .09]), and self-criticism (β = -.09, 95% CI [-.25, .06]) were not significantly directly associated with alcohol consequences. It was also observed that high standards (indirect β = -.01, 95% CI [-.03, .02]) nor self-criticism (indirect β = -.02, 95% CI [-.05, .01]) significantly mediated the association between PTSD and alcohol consequences. However, we did observe that overgeneralization (β = .14, 95% CI [.02, .27]), was significantly directly associated with alcohol consequences and uniquely mediated the relationship between PTSD and alcohol consequences (β = .04, 95% CI [.01, .07]), such the greater endorsement of PTSD symptoms was associated with more overgeneralization, which in turn was associated more negative alcohol related consequences.

Moderation Results

All main effects and interaction effects for our moderation models are shown in Table 3. Within our negative alcohol-related consequences model, there was only one significant main effect observed and no significant interaction effects. Specifically, higher PTSD was associated with greater alcohol consequences when controlling for all other predictors. Autobiographical memory

nor its interaction with PTSD were significantly associated with alcohol consequences. Within our alcohol quantity model, there were no significant main or interaction effects with the model (see Table 3).

Study One Discussion

The purpose of Study 1 was to further examine the relationship that exists between PTSD and alcohol quantity and consequences within the college student population by assessing additional factors such as attitudes toward self (ATS) and autobiographical memory. Based on the modern cognitive paradigm (Ehlers and Clark, 2000), the present study tested whether the subcomponents of ATS (i.e., high standards, overgeneralization, and self-criticism) mediated the relationship between PTSD and alcohol outcomes. We hypothesized that ATS would significantly mediate the relationship between PTSD and alcohol consumption and negative consequences. Our results were partially consistent with our hypothesis such that in our model examining alcohol consequences as an outcome, the relationship between PTSD and alcohol consequences was uniquely explained by overgeneralization such that higher PTSD was associated more overgeneralization, which in turn was associated with more negative alcohol consequences.

There are few possible explanations as to why overgeneralization emerged as the relevant ATS subscale linking PTSD symptoms to alcohol consequences. Overgeneralization refers to the tendency to generalize from one specific negative experience or failure to a broader sense of self-worthless (Carver and Ganellen, 1983). Although little to no research has examined

overgeneralization within the PTSD population, a litany of research has established it as a “cognitive style” (Van der Gucht, et al., 2015) and one that is very representative of an underlying factor in the vulnerability for depression (Carver 1998). It further suggests that overgeneralization may lead to more maladaptive responses, such as engaging in problematic alcohol use. In a study conducted by Kang et al. (2023), it was observed that individuals who were considered “risky drinkers” overgeneralized alcohol related gains and losses, further providing reasoning for more alcohol problems.

In our alcohol quantity mediation model, our hypothesis was once again only partially consistent with the current literature, such that only high standards uniquely mediated the relationship between PTSD and alcohol quantity. Specifically, PTSD symptoms were associated with higher standards, which in turn was associated with *less* alcohol quantity. In recent studies examining perfectionism in individuals with PTSD, it has been found that concern over mistakes, for instance, and clinical perfectionism were positively associated with PTSD symptoms This further validated earlier research findings which found significant correlations between PTSD symptoms and personal standards (Kawamura et al., 2001). Research examining the relationship between high standards and alcohol quantity, specifically within the college student population, has found that further reasoning for these results as well. In research examining “Socially Prescribed Perfectionism” (i.e., the belief that significant others expect oneself to be perfect) for instance, it was observed that those who scored higher on this construct also believed that others had very rigid expectations resulting in

them not wanting to disappoint others (Neumeister, 2004). Given this, it is possible that college students, specifically those with PTSD symptoms may not want to drink because they do not want to disappoint others. These findings could potentially explain the findings in our study and explain the significant negative mediation in this model; however empirical work replicating our results is needed. Overall, not only do our findings shed light on the importance of ATS in the relationships between PTSD and alcohol outcomes, but they demonstrate that more research should focus on evaluating these the differing components (e.g., high standards, overgeneralization, and self-criticism) separately.

Prior studies indicate that individuals with PTSD often experience difficulties in retrieving and integrating autobiographical memories, which can contribute to the development and maintenance of PTSD symptoms (Hauer et al., 2009). Given these research findings we hypothesized that autobiographical memory would weaken the relationship between PTSD symptoms and both alcohol use quantity and negative alcohol consequences. Our results were not consistent with the research findings as only one main effect was observed. When controlling for gender, autobiographical memory, and quantity in our moderation model, we found that higher PTSD symptoms were associated with greater alcohol consequences. This finding is not surprising and aligns with the litany of research that has established a positive association between PTSD and alcohol consequences. As previously mentioned, college students who have experienced trauma are more likely (compared to those who have not) to drink

heavily and experience unfavorable alcohol-related consequences (Anthenelli et al., 2018; Read et al., 2015).

Regarding autobiographical memory, a possible explanation as to why our results were not consistent with the research could be due in part to the autobiographical memory measure utilized in this study. The Brief ART is a more condensed version of the autobiographical memory questionnaire (AMQ), which is a 21-item measure that assesses autobiographical memory. Contrary to theory asserting that the worst parts of the trauma are disconnected from earlier and later information in memory (Ehlers et al., 2004), it is possible that because the Brief ART did not assess each property of autobiographical memory in their entirety, this resulted in a decreased capacity to conceptualize these experiences as more positive or negatively, thus resulting in less alcohol use and consequences. Future research should explore the relationships between PTSD, autobiographical memory, and alcohol outcomes using a more comprehensive measure of autobiographical memory.

Limitations and Future Directions

The generalizability of our findings is constrained by the convenience sampling of Psychology Department pool participants we used, even though we got a large sample size by recruiting students from several universities and states. Furthermore, because of the study's cross-sectional, non-experimental methodology, it is not possible to draw causal conclusions from the findings as we are unable to establish temporal precedence. An additional limitation is that socially sensitive information was self-reported, which could have led to

erroneous responses. Future research should examine the associations between PTSD, alcohol use outcomes, ATS, and autobiographical memory experimentally and investigate other protective factors (e.g., such as mindfulness) could impact these associations among college students.

Study Two

Mindfulness is defined as the practice of being aware of and accepting one's experience in the present moment, with the goal of facilitating nonjudgmental awareness of one's activities or surroundings (Brown & Ryan, 2003; Chambers et al., 2008). It is regarded as both a set of skills that may be honed through practice (Baer & Krietemeyer, 2006) and a trait in the sense that individuals differ in their proclivity for mindfulness (Brown & Ryan, 2003). Mindfulness has been linked to psychological well-being (Falkenstrom, 2010), likely because it aids in the acceptance of internal events (Brown & Ryan, 2003). Mindfulness has gained increasing attention as a potential intervention for individuals with PTSD, including college students. Previous researchers have indicated that regarding PTSD, Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy (MBCT), are expected to handle numerous discrepancies including but not limited to avoidance, hyperarousal, emotional numbing, shame and guilt, and even dissociation (Banks et al., 2015; Boyd et al., 2018; Follet et al., 2006; Frewen et al., 2015; Lang et al., 2012; Thompson et al., 2011). Focusing on college students, a study conducted by Dumarkaite et al. (2021) examined the effects of an 8-week mindfulness-based stress reduction program on PTSD symptoms among college students. The

results showed significant reduction in PTSD symptom severity, as well as improvements in psychological and overall mental well-being (Dumarkaite et al., 2021).

There is also a great deal of research of research illustrating the impact that mindfulness has on attitudes toward self (ATS). It has been proposed that long-term mindfulness meditation practices or interventions are closely linked to increases in positive self-attitudes, such as equanimity (not indifference) (Desbordes et al., 2015) and self-compassion (i.e., self-kindness, not self-criticism) (Hollis-Walker and Colosimo, 2011). At a qualitative level, some of the beneficial shifts in self-attitude can also be seen or explained. For example, compassion-focused meditation can help people who experience high levels of shame and self-criticism develop a sense of self-kindness (Gilbert, 2014).

Briefly mentioned in Study 1, over general autobiographical memory (OGM) is when there is an incapacity to recall specific memories from one's autobiographical memory for events that took place at a certain location and time and lasted less than a day (Williams & Broadbent, 1986). An early study conducted by Williams et al. (2000) found a significant reduction in OGM in individuals utilizing MBCT training. This study was later replicated by Heeren et al. (2009) and significant similar results were observed. Regarding individuals who have PTSD, not only can mindfulness-based therapies such as MBSR help in the reduction of PTSD symptoms (L. Davis et al., 2018; Polusny et al., 2015) but it is possible OGM could be further reduced as there are opportunities to

develop sustained attention and deliberate attention switching between stimuli which are presented by mindfulness (Jha et al., 2007).

Finally, mindfulness has also been shown to be particularly helpful as it relates to alcohol consumption in the college student population. In previous studies which sought to examine the efficacy of mindfulness-based therapy to reduce rates of binge drinking among college students, it was found that individuals in the mindfulness group showed significantly less binge episodes, as well as fewer alcohol consequences, compared to a control condition (Mermelstein et al., 2015). In a similar study examining PTSD symptoms and problematic alcohol consumption, participants placed within the mindfulness behavioral intervention group reported lower PTSD, drinking quantity, and negative alcohol consequences compared to a control group over a 4 – week time period (Valenstein-Mah et al., 2019). Focusing on alcohol craving, Mindfulness Based Relapse Prevention (MBRP), which utilizes previously proposed relapse prevention theory (Marlatt & Gordon, 1985), has been proven to be a successful intervention through which alcohol craving is attenuated (Witkiewitz & Bowen, 2010). Specifically, studies have shown that urge surfing, in which a drinker "accepts their disposition to drink" (Ofstafin & Marlatt, 2008), can be attenuated with MBRP. MBRP forces the participants to examine what pressures cause such urges and are given ways to not respond to them (Vadivale & Sathiyaseelan, 2019). Further and in line with the tenets of MRBP (i.e., urge surfing), recent studies have demonstrated that mindfulness induction

can reduce alcohol cravings in the moment among college student drinkers (Bravo et al., 2016; Kramer et al., 2013; Yusainy & Lawrence, 2015).

Study Two Purpose

Previous research findings suggest that mindfulness is a factor that should be heavily considered when it comes to ameliorating hazardous drinking within the college student population. Although a litany of research demonstrates the efficacy of mindfulness intervention in individuals endorsing PTSD symptoms (Banks et al., 2015, Frewen et al., 2015, Thompson et al., 2011), limited research has examined mindfulness within the college student population with PTSD. In one of the few studies examining the impact of mindfulness on PTSD and alcohol among college students, it was found that over 4-week mindfulness behavioral intervention participants reported lower PTSD symptoms, negative alcohol consequences, and drinking quantity (Valenstein-Mah et al., 2019). In expanding these prior research findings, the present study examined how being experimentally induced into a mindful state impacts alcohol craving, autobiographical memory, and ATS among college students who reported a prior traumatic event and consumed alcohol within the last 30 days. We hypothesized that the individuals in the mindfulness condition will report greater increases in autobiographical memory, greater increases in ATS, and greater decreases in alcohol craving compared to the control condition post experimental manipulation. Further, we expected that improvements in these outcomes within the mindfulness condition (compared to the control condition) would be greater among participants reporting probable PTSD (i.e., test of moderation).

Study Two Methods

Participants

Participants were recruited through the Psychological Sciences Department Sona System at William & Mary. Participants were selected to participate so long as they had access to Sona Systems, had consumed alcohol at least once in the last 30 days, indicated a history of prior trauma exposure, and were at least 18 years of age. All 75 students recruited received questionnaires concerning PTSD symptoms, ATS, autobiographical memory, alcohol quantity, negative alcohol consequences, and alcohol craving. Upon completion of the study participants received Sona credit. Participants primarily identified as being White, non-Hispanic (81.9%), female (61.1%), and reported a mean age of 19.29 (Median = 19.00; *SD* = 1.41) years.

Experimental Procedure

Students who enrolled in classes where research participation is offered for course credit or extra credit had the opportunity to complete a preliminary survey (i.e., Mass Testing). If they met inclusion criteria (i.e., consumed alcohol at least once in the last 30 days, indicated a history of prior trauma exposure, and were at least 18 years of age) based on responses on Mass Testing, they were invited to participate in the current study. Upon arrival at the laboratory, participants received information about the study before providing informed consent. All participants were informed they were free to leave any question blank or stop the survey if they felt any major discomfort. After giving consent, all participants completed a battery of measures which consisted of all the

measures in Study 1 except for the Brief Autobiographical Memory, which was replaced with the Autobiographical Memory Questionnaire (Rubin et al., 2011). Additionally, measures for state mindfulness and alcohol craving were assessed. Participants were randomly assigned to either a mindfulness or control condition in which they listened to an audio using headphones and after the experimental paradigms, completed measures on state mindfulness and alcohol craving again once more.

Experimental Conditions

Mindfulness Condition. Students randomized to the mindfulness condition were prompted to listen to an eight-minute mindfulness audio clip: Mindfulness of the Body and Breath (Williams and Penman, 2011). This was an introduction to Mindfulness and guided participants to direct their attention towards witnessing the full sensations of breathing without the intention of altering these experiences, and to notice in an accepting manner when their minds wander and gently return their focus to their breathing. A prior study utilized the same mindfulness audio clip to successfully induce state mindfulness among college students (Bravo, 2016).

Control Condition. Students randomized to the control condition were prompted to listen to a seven-and-a-half-minute audio on fruit flies titled “Fruit Fly Scientist Swatted Down Over Cheap Date” (All Things Considered, 2010). This audio discussed the discovery of fruit flies and their nomenclature. A prior study also used this as a control condition to compared to a mindfulness induction on state mindfulness (Bravo, 2016).

Measures

For this study, all the measurements utilized in Study 1 were assessed and all once again had acceptable-to-excellent internal consistency statistics. However, the Autobiographical Memory Questionnaire was administered instead of the Brief Autobiographical Recollection Test (ART) to assess more detailed properties of each nominated memory. Further, state mindfulness and alcohol craving were assessed in the present study.

State Mindfulness. The State Mindfulness Scale (SMS; Tanay and Bernstein 2013) was used to measure state mindfulness. The SMS is a 21-item self-report measure that utilizes a 5-point Likert scale (1 = "*not at all"* to 5 = "*very well"*). The measure assesses state mindfulness of mind (e.g., "I was aware of what was going on in my mind"; 15 items) and state mindfulness of body (e.g., "I noticed physical sensations come and go"; 6 items) immediately following a mindfulness experience (i.e., mindfulness induction). Items on the SMS were summed for each scale and used a manipulation check of state mindfulness after the mindfulness induction (body, α = .88; mind α = .88).

Autobiographical Memory. A modified version of the Autobiographical Memory Questionnaire (AMQ: Rubin et al., 2011) was used to measure autobiographical memory. The AMQ is a 21-item measure that assesses the properties of each nominated memory using a 7-point Likert scale (1= *"Strongly Agree",* 7= *"Strongly Disagree*"). For the present study, we focused on the following subscales: emotional intensity (e.g., "While remembering, the emotions that I feel are extremely intense) (pre-manipulation α = .84)., rehearsal (e.g.,

"Since it happened, I have thought or talked about this event.") (pre-manipulation α = .75), sensory and language processes e.g., "While remembering the event, I can see it in my mind") (pre-manipulation α = .75)., and narrative (e.g., "It comes to me in words or in pictures as a coherent story") (pre-manipulation α = .72). Items for each subscale were averaged such that higher scores indicate higher endorsement of that subscale. Prior to completing this measure, participants were instructed to think of one prior traumatic event and respond to questions from this measure with that prior event in mind.

Alcohol Craving. The modified version of the Desires for Alcohol Questionnaire (Kramer et al., 2010) was used to measure alcohol craving. The DAQ is a 14-item questionnaire that evaluates alcohol craving using a 7-point Likert scale (1 = *"strongly disagree"* to 7 = *"strongly agree"*). The three facets measured are: alcohol craving: strong desires/intentions to drink (e.g., "I want to drink so much I can almost taste it"), negative reinforcement (e.g., "Even major problems in my life would not bother me if I drank now"), and positive reinforcement (e.g., "Drinking would be pleasant now"). Similar to prior studies (Dickter et al., 2014; Bravo et al., 2016), all items were summed to create a total subjective craving score (pre-manipulation α = .87).

Analyses Plan

All statistical analyses were conducted using SPSS software package (version 27.0). A 2x2 repeated measures ANOVA was conducted with audio as a grouping variable and each outcome (i.e., autobiographical memory, ATS, alcohol craving) entered as the within-subject dependent variable. Alcohol

quantity was entered as covariate within the ANOVAs. Statistical significance was determined using a p <.05 cut off for the ANOVAs. Given the number of models tested, significant results were confirmed with post-hoc Bonferroni tests. Among significant interaction effects, follow-up analyses included PTSD as a grouping variable. Specifically, individuals were categorized as either 0= did not meet the cut off for probable PTSD or 1=met cutoff, based on a score of >33 on the PCL-5 measure (Blevins et al., 2015). Among our sample, 54% of the individuals met the criteria for probable PTSD.

Study Two Results

Before analyses were conducted, data were cleaned, and statistical assumptions were tested. Specifically, we ran a series of independent measures t-tests where means (prior to the randomization) across each study variable were compared between individuals randomized to the mindfulness condition (N=35) and individuals randomized to the control condition (N=36). Results of the independent samples t-tests did not reveal any significant differences between audio groups on outcomes pre-manipulation, such that those randomized to the mindfulness condition did not differ significantly from those who were randomized to the control condition. Specifically, there were no significant differences in ATS subscales (i.e., high standards t (69) = -.98, p = .42, 95% CI [-.54, 0.18], self-criticism t (69) = .12, p = .06, 95% CI [-.35, 0.40], overgeneralization t (69) = 1.34, p = .30, 95% CI[-.15, 0.78]); Autobiographical memory subscales (i.e., emotions t (68) = -1.57, p = .74, 95% CI [-1.31, .16], rehearsal t (68) = -1.70, p = .42, 95% CI [-1.42, 0.12], sensory t (68) = -.27, p = .90, 95% CI [-.76, 0.58], narrative t(68) = -

1.0, p = .66, 95% CI [-1.0, 0.33], and alcohol craving t (69) = -1.06, p = .36, 95% CI [-9.18, 2.80],

Independent t-test results indicated that there was not a significant difference on state mindfulness of mind across audio conditions, t (69) = -1.17, p = .25, 95% CI [-8.54, .2.23]. However, we did find significant differences for state mindfulness of *body, t* (69) = -3.07, p = .02, 95% CI [-7.13, -1.51] post manipulation, such that those randomized to the mindfulness condition reported greater state mindfulness of body.

In examining alcohol craving, there was a significant interaction observed F (1,67) = .009, p < .05, partial η2 = .10 (see Table 4). Specifically, individuals who were randomized to the mindfulness condition reported a greater reduction in craving for alcohol (Mean pre-manipulation = 37.10; Mean post-manipulation = 32.61 ; Mean difference = 4.49), compared to those in the control condition (Mean pre-manipulation = 35.53; Mean post-manipulation = 34.84 ; Mean difference = 0.69). In follow-up analyses, probable PTSD was further incorporated into the model as a grouping variable and our significant results on carving remained consistent, indicating that PTSD grouping did not moderate this significant interaction effect (see Table 5). Contrary to our hypothesis, the repeated measures ANOVAs revealed no significant differences in autobiographical memory components and ATS across audio conditions (See Tables 6-12).

Study Two Discussion

The purpose of the present study was to examine how being experimentally induced into a mindful state impacts alcohol craving, autobiographical memory, and ATS among college students who reported a prior traumatic event and consumed alcohol within the last 30 days.

Contrary to our hypothesis, our analyses revealed no significant differences in either autobiographical memory or ATS post the mindfulness condition. Although the research suggests a positive association between mindfulness and memory (Williams et al., 2000), it is not entirely surprising that we did not find statistical significance. Particularly relevant to this study is its small sample size, making it more susceptible to individual differences. Research has shown the effects of mindfulness on memory may be moderated by individual differences (Tang & Braver, 2020). This highlights the importance of considering various factors that could impact the relationship between mindfulness and memory within college students. Like autobiographical memory, individual differences could be the reason for the lack of significant findings for ATS subscales as well. Despite not finding statistical significance in this study, the lack of increase of autobiographical memory is still a relatively valuable finding. These results were consistent across various autobiographical memory components. It reveals that further exploration of relationships between autobiographical memory and attitudes toward self are needed as well as exploring additional variables and measurement techniques to provide a more comprehensive understanding of the

impact of mindfulness on autobiographical memory and ATS among those who have experienced a prior traumatic event.

In line with current research (Bravo et al., 2016; Kramer et al., 2013; Yusainy & Lawrence, 2015), mindfulness did decrease alcohol craving for those randomized to the mindfulness condition. The successful reduction in alcohol craving among participants in the mindfulness condition not only supports the existing evidence but also underscores the potential on mindfulness practices into comprehensive addiction treatment programs. Clinicians and researchers can enhance the effectiveness of these interventions and improve outcomes for college students who may be struggling with alcohol use disorders. The results also demonstrated that individuals meeting the criteria for probable PTSD did not impact the significant decreases in alcohol craving found in the mindfulness condition. PTSD might not moderate the relationship between alcohol craving and mindfulness due to the complexity of the interaction among these variables. While PTSD symptoms and alcohol craving may have individual impacts on mindfulness practices and outcomes, the specific interaction between them may not be directly influenced by the presence of PTSD.

Limitations and Future Directions

The present study's findings should be interpreted within the context of several limitations that may have influenced the results and warrant consideration in future research endeavors. One crucial limitation is the use of a very small sample size, which could have compromised the generalizability and statistical power of the study. With a limited number of participants, the study

may not have been able to capture the full range of individual differences and nuances in experiences related to alcohol craving and mindfulness interventions among college students. As such, the findings may not be representative of the broader population or may have been influenced by chance variations within the sample. Like study 1, the measures were self-report which could lead to erroneous responses.

General Discussion

According to Hingson et al. (2009) and White & Hingson (2013), excessive alcohol use among college students can have a negative impact on their health, increasing their risk of physical assault, cognitive decline, and even death. Despite these negative outcomes, over 45%of college students report binge drinking occasionally within the past month (Hua et al., 2022). Considering these kinds of at-risk behaviors, it's critical to pinpoint the variables that both mitigate these effects—such as protective factors, including social support and mindfulness (Haliwa et al., 2022) and any variables that can aggravate them, like PTSD. Furthermore, studies indicate that even among students who fit the criteria for other diseases, individuals with PTSD exhibit more dangerous patterns of substance usage (McDevitt-Murphy et al., 2010).

The present studies aimed to examine the relationship between PTSD, autobiographical memory, ATS, and alcohol quantity and consequences. Considering the proven benefits of mindfulness in relation to alcohol craving (Bravo et al., 2016) and alcohol consequences (Valenstein-Mah et al., 2019), we further expanded on the current findings experimentally. The major takeaways

from the combined results of the two studies highlights the complex relationships between alcohol-related consequences, PTSD symptoms, cognitive factors like high standards and overgeneralization, self-criticism, autobiographical memory, and alcohol craving. Although Study 1 focused on correlations and mediation and moderation analysis while Study 2 examined group differences and effects post-manipulation, both studies emphasized the interconnectedness of various factors in individuals experiencing alcohol-related problems and PTSD symptoms. Additionally, the studies demonstrated the importance of considering multiple variables simultaneously in understanding the complex nature of alcohol use and related consequences in individuals at risk for PTSD.

Overall, the collective findings suggest the need for comprehensive and integrated approaches when addressing issues related to alcohol use and PTSD. By identifying the relationships between different factors (e.g., ATS, autobiographical memory, mindfulness) that may impact this relationship, interventions can be tailored to target specific mechanisms that contribute to negative outcomes, thereby potentially improving treatment outcomes for individuals with co-occurring alcohol use disorder and PTSD symptoms.

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Table 1
Bivariate correlations among study variables in total sample (n = 376)

	1	2	3	4	5	6	7	*M*	*SD*	*Range*
1. BYAACQ	---							5.51	4.73	1.00 – 24.00
2. Alcohol Quantity	**.47**	---						11.63	9.66	---
3. PTSD (Total Score)	**.25**	.08	---					23.01	20.81	0.00 – 80.00
4. ATS (High Standards)	-.08	**-.13**	**.14**	---				4.02	0.87	1.00 – 7.00
5. ATS (Overgeneralization)	**.12**	-.02	**.27**	**.34**	---			3.69	0.86	1.00 – 7.00
6. ATS (Self Criticism)	.01	-.04	**.21**	**.69**	**.68**	---		4.11	0.78	1.00 – 7.00
7. ART	**.14**	.05	**.38**	.09	.08	.10	---	4.39	1.28	1.00 – 7.00

Note. Significant correlations are bolded for emphasis and were determined by a 95% bias-corrected standardized bootstrapped confidence interval (based on 10,000 bootstrapped samples) that does not contain zero. BYYACQ = Brief-Young Adult Alcohol Consequences Questionnaire; PTSD =Post-Traumatic Stress Disorder; ATS = Attitudes Toward Self; ART = Autobiographical Recollection Test.

Table 2

Summary of total, indirect, and direct effects of comprehensive mediation path model

Alcohol Outcome Variables:	*Negative Consequences*		*Alcohol Quantity*	
Predictor Variable: *PTSD Symptoms*	β	95% CI	β	95% CI
Total	**.22**	**0.13, 0.30**	.08	-0.01, 0.16
Total indirect[a]	.01	-0.01, 0.04	-.01	-0.04, 0.01
ATS (High Standards)	-.01	-0.03, 0.02	**-.03**	**-0.06, -0.003**
ATS (Self Criticism)	-.02	-0.05, 0.01	.02	-0.01, 0.06
ATS (Overgeneralization)	**.04**	**0.01, 0.07**	-.01	-0.04, 0.02
Direct	**.20**	**0.11, 0.29**	**.09**	**0.002, 0.18**

Note. Significant associations are in bold typeface for emphasis and were determined by a 95% percentile-based standardized bootstrapped confidence interval (based on 10,000 bootstrapped samples) that does not contain zero. [a] Reflects the combined indirect associations within the model. BYYACQ = Brief-Young Adult Alcohol Consequences Questionnaire; PTSD = Post Traumatic Stress Disorder; ATS = Attitudes Toward Self; ART = Autobiographical Recollection Test.

Table 3

Summary of effects of PTSD, Autobiographical memory, and their interaction on negative alcohol consequences and quantity

	Negative Consequences				
Model Information: $n = 376$; $R^2 = .275$	β	*SE*	*t*	*p*	95% CI
PTSD (Total Score)	**.19**	**.05**	**3.75**	**.0002**	**.09, .28**
ART	.05	.05	1.00	.319	-.05, .14
PTSD × ART	.05	.04	1.19	.234	-.03, .13
Effect of PTSD at low (1 SD below mean) ART	.14	.07	1.92	.055	-.003, .28
Effect of PTSD at average ART	**.19**	**.05**	**3.75**	**.0002**	**.09, .28**
Effect of PTSD at high (1 SD above mean) ART	**.24**	**.06**	**4.15**	**.0000**	**.12, .35**
	Alcohol Quantity				
Model Information: $n = 376$; $R^2 = .016$	β	*SE*	*t*	*p*	95% CI
PTSD (Tota1 Score)	.07	.05	1.43	.152	-.03, .17
ART	.02	.05	0.43	.671	-.07, .11
PTSD × ART	-.01	.04	-0.12	.902	-.08, .07
Effect of PTSD at low (1 SD below mean) ART	.07	.07	1.07	.287	-.06, .21
Effect of PTSD at average ART	.07	.05	1.43	.152	-.03, .17
Effect of PTSD at high (1 SD above mean) ART	.06	.06	1.16	.245	-.04, .17

Note. Significant associations are in bold typeface for emphasis and were determined by a 95% percentile-based standardized bootstrapped confidence interval (based on 10,000 bootstrapped samples) that does not contain zero. [a] Reflects the combined indirect associations within the model. BYYACQ = Brief-Young Adult Alcohol Consequences Questionnaire; PTSD = Post Traumatic Stress Disorder; ATS = Attitudes Toward Self; ART = Autobiographical Recollection Test.

Table 4

Alcohol craving immediately before (C2) and after (C3) audio manipulation, as a function of audio group assignment.

Within-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
Craving	74.20	1	74.20	4.52	.037	0.06
Craving*Alcohol Quantity	7.05	1	7.05	7.05	.514	0.01
Craving*Audio	123.87	1	123.87	7.55	.008*	0.10
Between-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
Alcohol Quantity	82.87	1	82.87	0.20	.66	.003
Audio (Mindfulness vs. Control)	3.81	1	3.81	0.01	.924	0.00

Note. * indicates a p-value of statistical significance ($p < .05$).

Table 5

Alcohol craving immediately before (C2) and after (C3) audio manipulation, as a function of audio group assignment and PTSD clinical group

Within-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
Craving	64.05	1	64.05	3.86	.054	0.06
Craving*Alcohol Quantity	7.63	1	7.63	0.46	.500	0.01
Craving*Audio	109.36	1	109.36	6.59	.013*	0.09
Audio*Clinical	18.79	1	18.79	1.13	.291	0.02
Craving*Audio*Clinical	1.87	1	1.87	.113	.738	0.002
Between-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
Alcohol Quantity	236.56	1	236.56	0.63	.432	0.002
Audio	20.07	1	20.07	0.05	.818	0.001
Clinical	2851.45	1	2851.45	7.55	.008*	0.104
Audio*Clinical	236.56	1	236.56	0.63	.432	0.01

Note. * indicates a p-value of statistical significance ($p < .05$).

Table 6

ATS (High Standards) immediately before (T1) and after (T2) audio manipulation, as a function of audio group assignment

Within-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
ATS	0.002	1	0.002	0.021	.884	0.000
ATS*Alcohol Quantity	0.08	1	0.08	0.86	.358	0.01
ATS*Audio	0.16	1	0.16	1.69	.198	0.03
Between-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
Alcohol Quantity	5.02	1	5.02	4.31	.042	0.06
Audio (Mindfulness vs. control)	2.77	1	2.77	2.37	.128	0.03

Note. * indicates a p-value of statistical significance ($p < .05$).

Table 7

ATS (Self-Criticism) immediately before (T1) and after (T2) audio manipulation, as a function of audio group assignment

Within-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
ATS	0.05	1	0.05	0.32	.575	0.01
ATS*Alcohol Quantity	0.19	1	0.19	1.26	.265	0.02
ATS*Audio	0.01	1	0.01	0.07	.799	0.001
Between-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
Alcohol Quantity	1.89	1	1.89	1.61	.209	0.02
Audio (Mindfulness vs. control)	0.18	1	0.18	0.15	.700	0.002

Note. * indicates a p-value of statistical significance ($p < .05$).

Table 8

ATS (Overgeneralization) immediately before (T1) and after (T2) audio manipulation, as a function of audio group assignment

Within-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
ATS	0.11	1	0.11	1.43	.236	0.02
ATS*Alcohol Quantity	0.02	1	0.02	0.29	.594	0.004
ATS*Audio	0.03	1	0.03	0.41	.524	0.01
Between-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
Alcohol Quantity	1.95	1	1.95	1.05	.310	0.02
Audio (Mindfulness vs. control)	5.01	1	5.01	2.69	.106	0.04

Note. * indicates a p-value of statistical significance ($p < .05$).

Table 9

AMQ (Emotional Intensity) immediately before (T1) and after (T2) audio manipulation, as a function of audio group assignment

Within-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
AMQ	1.41	1	1.41	1.81	.183	0.03
AMQ*Alcohol Quantity	0.37	1	0.37	0.48	.491	0.01
AMQ*Audio	0.61	1	0.61	0.78	.381	0.01
Between-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
Alcohol Quantity	1.74	1	1.74	0.42	.520	.01
Audio (Mindfulness vs. control)	15.42	1	15.42	3.71	.058	.05

Note. * indicates a p-value of statistical significance ($p < .05$).

Table 10

AMQ (Rehearsal) immediately before (T1) and after (T2) audio manipulation, as a function of audio group assignment

Within-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
AMQ	0.19	1	0.19	0.31	.579	.01
AMQ*Alcohol Quantity	0.54	1	0.54	0.88	.352	.01
AMQ*Audio	0.16	1	0.16	0.27	.607	.004
Between-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
Alcohol Quantity	3.74	1	3.74	0.83	.367	.01
Audio (Mindfulness vs. control)	8.34	1	8.34	1.84	.180	.03

Note. * indicates a p-value of statistical significance ($p < .05$).

Table 11

AMQ (Sensory) immediately before (T1) and after (T2) audio manipulation, as a function of audio group assignment

Within-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
AMQ	0.16	1	0.16	0.26	.612	.004
AMQ*Alcohol Quantity	0.40	1	0.40	0.65	.422	.01
AMQ*Audio	0.47	1	0.47	0.77	.384	.01
Between-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
Alcohol Quantity	0.01	1	0.01	0.002	.968	.000
Audio (Mindfulness vs. control)	0.16	1	0.157	0.05	.826	.001

Note. * indicates a p-value of statistical significance ($p < .05$).

Table 12

AMQ (Narrative) immediately before (T1) and after (T2) audio manipulation, as a function of audio group assignment

Within-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
AMQ	0.01	1	0.01	0.01	.918	.000
AMQ*Alcohol Quantity	0.22	1	0.22	0.25	.622	.004
AMQ*Audio	0.88	1	0.88	1.00	.321	.02
Between-subjects factors						
Source	SS	df	MS	*F*	*p*	η^2
Alcohol Quantity	0.07	1	.07	.02	.883	.000
Audio (Mindfulness vs. control)	0.56	1	0.56	0.19	.669	.003

Note. * indicates a p-value of statistical significance ($p < .05$).

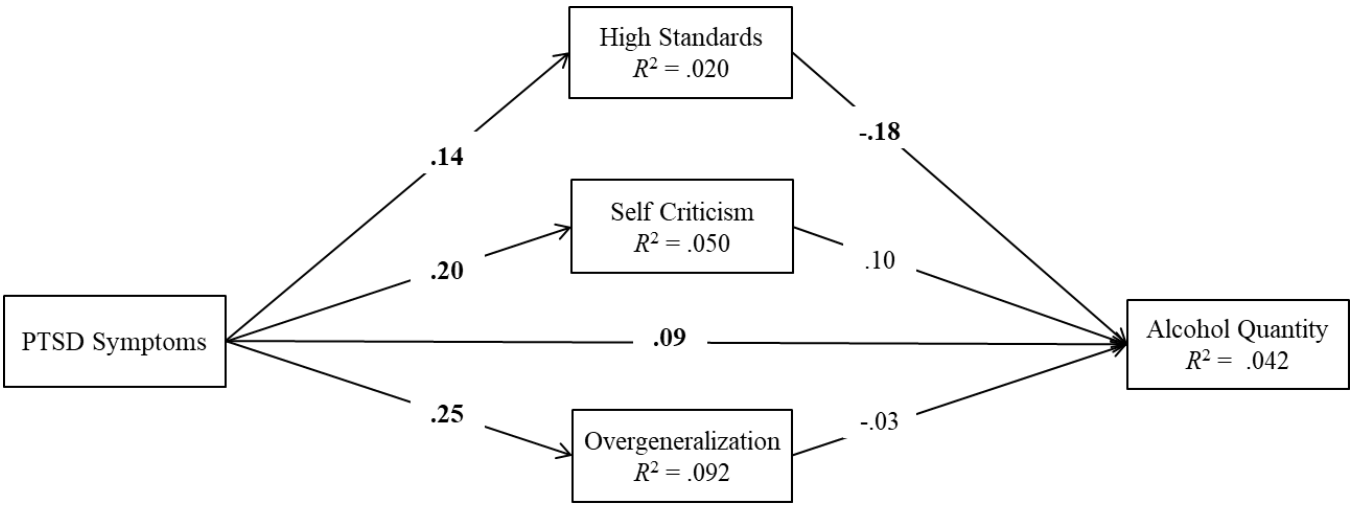

Figure 1. Standardized effects of the comprehensive mediation path model predicting typical alcohol quantity (*n* = 376).

Note. Significant associations are in bold typeface for emphasis and were determined by a 95% percentile-based standardized bootstrapped confidence interval (based on 10,000 bootstrapped samples) that does not contain zero.

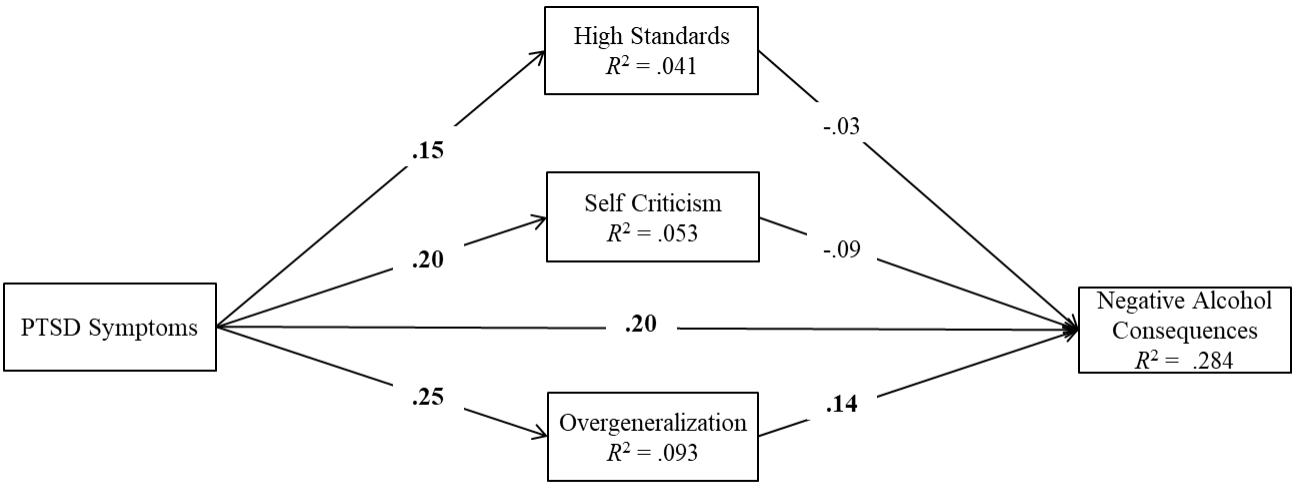

Figure 2. Standardized effects of the comprehensive mediation path model predicting negative alcohol-related consequences (*n* = 376).

Note. Significant associations are in bold typeface for emphasis and were determined by a 95% percentile-based standardized bootstrapped confidence interval (based on 10,000 bootstrapped samples) that does not contain zero.