APPLICATION OF THE STRESSOR VULNERABILITY MODEL TO POSTTRAUMATIC STRESS DISORDER (PTSD) AND ALCOHOL-RELATED PROBLEMS IN AN UNDERGRADUATE POPULATION

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by

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INTRODUCTION

Posttraumatic stress disorder (PTSD) is an anxiety disorder affecting between 7.8-9.2% of the United States population (Breslau, Davis, Andreski, & Peterson, 1991; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995). To qualify for a PTSD diagnosis, an individual must experience an event that involves threat of harm to either themselves or someone else, evoking a response of intense fear, helplessness, or horror (American Psychiatric Association, 2000). In addition, individuals exposed to such events must report experiencing symptoms that can be grouped into three categories: reexperiencing symptoms (e.g. reliving the traumatic event and feeling as if it were re-occurring), avoidance symptoms (e.g. avoiding places, situations, or people that are associated with the traumatic event), and hyperarousal symptoms (e.g. feeling jumpy or being overly alert). A PTSD diagnosis is considered when a trauma victim reports the presence of these symptoms for at least 1-month and also experiences functional impairment in one or more domains of life as a result of their trauma symptoms (APA, 2000).

PTSD frequently co-occurs with a variety of other psychiatric disorders including major depression, dysthymia, generalized anxiety disorder, and simple phobia (Breslau et. al., 1991; Breslau, Davis, Peterson, & Schultz, 2000; Kessler et. al., 1995; O’Donnell, Creamer, & Pattison, 2004). One of the most frequently comorbid disorders associated
with PTSD are substance use disorders (SUDs). Amongst individuals seeking treatment for alcohol or drug use, PTSD prevalence rates range from 28-55% (Coffey, Schumacher, Brady, & Cotton, 2007; Ouimette, Read, & Brown, 2005; Staiger, Melville, Hides, Kambouropoulos, & Lubman, 2009). In the general population, SUDs affect approximately 43% of individuals diagnosed with PTSD (Breslau et. al., 1991). Alcohol use disorders (AUDs) are particularly common, with up to 52% of men and 28% of women with PTSD also meeting lifetime criteria for alcohol abuse or dependence (Kessler et. al., 1995).

In addition, individuals with alcohol dependence are 2.2 times more likely to experience PTSD in the past year compared to individuals without alcohol dependence (Kessler et. al., 1996). This comorbidity is significant, given that individuals with PTSD-AUD report poorer physical health and quality of life, as well as greater PTSD symptoms and psychosocial impairments – including higher rates of unemployment and less social support – compared to individuals with either disorder alone (Riggs, Rukstalis, Volpicelli, Kalmanson, & Foa, 2003; Ouimette, Goodwin, & Brown, 2006; Saladin, Brady, Dansky, & Kilpatrick, 1995).

Researchers investigating the co-occurrence of PTSD and AUD have proposed a variety of explanations to account for this comorbidity, perhaps the most common explanation being the self-medication hypothesis. According to this hypothesis, individuals with PTSD use substances to self-medicate or relieve the psychological distress that they experience as a result of their trauma symptoms (Brady, Back, & Coffey, 2004; Stewart, 1996; Stewart, Pihl, Conrod, & Dongier, 1998). In other words, as conceptualized in the
alcohol use literature, the self-medication hypothesis corresponds to a simple tension reduction model of alcohol use in which problematic drinking is proposed to arise from the stress-dampening effects of alcohol. According to this view, alcohol serves as negative reinforcement, reducing the tension associated with the experience of psychological distress (Greeley & Oei, 1999).

Several lines of research support the validity of the self-medication hypothesis as an explanation for PTSD-AUD comorbidity. For example, correlational research with Vietnam veterans demonstrates that PTSD symptoms and alcohol use tend to increase in tandem (Bremner, Southwick, Darnell, & Charney, 1996). Other research with patients receiving substance abuse treatment has extended this finding by demonstrating that PTSD and AUD are perceived as functionally connected amongst those with both disorders. For instance, in a mixed sample of alcohol and drug dependent individuals undergoing detoxification, 51.4% of those surveyed indicated that when their substance use worsened, their trauma symptoms worsened as well. In contrast, 77.1% indicated that when their trauma symptoms worsened, their substance use also worsened. Consistent with the self-medication hypothesis, this suggests that trauma symptoms exacerbate substance use symptoms for a large percentage of individuals experiencing both disorders. However, given that over half of those surveyed also stated that substance use worsened symptoms of PTSD, this finding also leaves open the possibility that a cyclical relationship exists between the two disorders such that each serves to aggravate the other (Brown, Stout, & Gannon-Rowley, 1998). More definitive support for the self-medication hypothesis comes from research examining craving and psychological distress elicited in response to neutral
vs. trauma cues amongst those with PTSD and either alcohol dependence or cocaine dependence. This research demonstrated that compared to neutral cues both groups displayed elevated craving and distress when presented with trauma cues. Furthermore, individuals with PTSD and alcohol dependence reported greater craving and distress compared to individuals with PTSD and cocaine dependence (Coffey et. al., 2002).

Finally, the relationship between distress and alcohol craving in individuals with PTSD and alcohol dependence has been shown to weaken following the reduction of trauma symptoms secondary to trauma cue exposure (Coffey, Stasiewicz, Hughes, & Brimo, 2006).

While the evidence above seems to suggest that the self-medication hypothesis can help to explain PTSD-AUD comorbidity, it is widely recognized within the alcohol use literature that a simple tension-reduction model does not comprehensively explain the relationship between stress and alcohol use. For example, studies considering the relationship between self-reported stress and alcohol consumption have indicated that drinking can sometimes provoke (Cameron, Liepman, Curtis, & Thyer, 1987; Dengerink & Fagan, 1978) dampen (Levenson, Sher, Grossman, Newman, & Newlin, 1980; Sher & Levenson, 1982) or have null effects (Sayette, Contrada, & Wilson, 1990; Sayette & Wilson, 1991) on stress levels. Inconsistent findings such as these have led researchers to consider how the presence of a number of individual difference variables may serve as moderators of the stress-alcohol use relationship. In particular, considerable support has been garnered for the stressor vulnerability model (Cooper, Russell, & George, 1988; Cooper, Russell, Skinner, Frone, & Mudar, 1992). According to this model, psychological
distress motivates drinking in only a subset of individuals possessing specific personal characteristics that serve as vulnerability factors. These characteristics include being male, relying on maladaptive forms of coping (such as avoidance coping), and holding beliefs that drinking alcohol will result in positive outcomes (referred to as positive alcohol outcome expectancies). In their original test of this model, Cooper and colleagues (1992) examined a community sample of adults and found that greater numbers of life stressors tended to predict greater 12-month alcohol problems for men who reported greater reliance on avoidance coping when dealing with a stressor or greater positive alcohol outcome expectancies.

To explain these findings, Cooper et. al. (1992) framed their results within a social learning context (Bandura, 1969, 1977, 1986). According to this perspective, the vulnerability factors identified by the stressor vulnerability model are proposed to exist due to the influence of models present in the social environment during development (Cooper, Russell, & Frone, 1990; Cooper, Russell, & George, 1988; Maisto, Carey, & Bradizza, 1999). Thus, the finding that men are more likely to engage in alcohol use when experiencing negative emotion may be due to socialization processes that lead males to engage in externalizing behaviors including alcohol use when experiencing distress (Dohrenwend & Dohrendwend, 1976; Horwitz & White, 1987). Avoidance coping strategies in which an individual seeks to avoid some stressor in an effort to manage the negative affect associated with it are proposed to arise when more adaptive, proactive coping strategies are not modeled in the social environment (Bandura, 1969). Likewise,
positive alcohol outcome expectancies are posited to arise from caregivers and peers who exhibit drinking behaviors consistent with that belief (Brown, Cremer, & Stetson, 1987).

Subsequent research has supported the validity of the stressor vulnerability model in younger populations including adolescents (Laurent, Catanzaro, & Callan, 1997; Catanzaro & Laurent, 2004). Further, this model has been more recently tested within a daily-diary framework, which reduces the effects of recall error by having participants report on stress levels and alcohol consumption closer to the time at which they naturally occur. Using this methodology, Armeli, Carney, Tennen, Affleck, & O’Neil (2000) found that on days in which a greater number of negative, stressful life events occurred, men with greater positive alcohol outcome expectancies reported greater alcohol consumption, supporting the original findings by Cooper et. al. (1992).

With respect to the relationship between traumatic stress and alcohol use, several of the vulnerability factors proposed by the stressor vulnerability model have been considered as variables influencing PTSD-AUD comorbidity. For example, avoidance coping strategies and positive alcohol outcome expectancies have been shown to mediate the relationship between PTSD and alcohol consumption/substance use outcomes two years later in male veterans (Ouimette, Finney, & Moos, 1999). Similarly, in a community sample of women, avoidance coping strategies and educational level partially mediated the relationship between childhood trauma and both alcohol/drug use and psychological distress (Min, Farkas, Minnes, & Singer, 2007). However, to date no study has examined the full range of vulnerability factors (i.e. gender, avoidance coping, and positive alcohol outcome expectancies) proposed by the stressor vulnerability model in the same sample.
Such a consideration is important because the identification of vulnerability factors can help to target those who are most likely to exhibit PTSD-AUD comorbidity. In addition, prior studies considering the constructs of this model in the context of PTSD-AUD comorbidity have relied on same-sex samples of middle-aged individuals who have had PTSD and alcohol use problems for many years. Given the significant physical health problems, poorer quality of life, and psychosocial impairments associated with PTSD-AUD comorbidity, research conducted with younger populations consisting of both males and females is warranted so that interventions can be designed that will curtail these problems before they take their full toll on functioning.

Research with college students demonstrates that PTSD rates are comparable to those observed in the general population, affecting between 7-8% of students (Green et. al., 2005; McDevitt-Murphy, Weathers, Flood, Eakin, & Benson, 2007). In addition, AUD rates in college students are similar to those observed in community samples and may be elevated relative to the general population (Kessler, Chiu, Demler, & Walters, 2005; Knight et. al., 2002). Furthermore, stress-motivated drinking patterns are frequently reported by undergraduates and are associated with increased alcohol-related problems in the years following college (Perkins, 1999). Despite these characteristics, research considering the relationship between PTSD and alcohol use in college populations is lacking (for a review see Borsari, Read, & Campbell, 2008). Collectively, the prevalence of PTSD, AUDs, and stress-motivated drinking – combined with the limitations associated with the existing research applying the constructs of the stressor vulnerability model to the
co-occurrence of PTSD-AUD – suggests that a full test of the stressor vulnerability model as an explanatory model of PTSD-AUD comorbidity in a college population is warranted.

The present study aimed to explore the validity of the stressor vulnerability model in explaining the relationship between PTSD symptoms (PTSS) and problems related to drinking alcohol in undergraduates. This was accomplished by examining the moderating impact of sex, avoidance coping, and positive alcohol outcome expectancies on the relationship between PTSS and alcohol-related problems. While sex differences in PTSD prevalence rates are typically attenuated in SUD populations (Stewart, Grant, Ouimette, & Brown, 2006), males are more likely to exhibit PTSD-AUD comorbidity compared to females in the general population (Kessler et. al., 1995). Thus, in the current study it was anticipated that the PTSS-alcohol-related problems relationship would be greater for males. However, consistent with the results observed by Cooper et. al. (1992), it was further anticipated that this 2-way interaction between PTSS and sex would be qualified by the degree to which an individual either engaged in avoidance coping or held positive alcohol outcome expectancies. More specifically, it was hypothesized that a 3-way interaction between PTSS, sex, and avoidance coping would be observed, as well as a 3-way interaction between PTSS, sex, and positive alcohol outcome expectancies. While a variety of positive alcohol outcome expectancies have been reported in the alcohol literature (e.g. Brown, Christiansen, & Goldman, 1987), given the support described above for the self-medication hypothesis, tension reduction expectancies that drinking alcohol will reduce negative emotion were considered especially relevant to the study’s aims and thus served as the positive alcohol outcome expectancies of interest.
In addition to these personal characteristics, the current study aimed to extend the stressor vulnerability model by considering how drinking refusal expectancies may also serve as a vulnerability factor for PTSD-AUD comorbidity. Drinking refusal expectancies refer to the beliefs that a person holds concerning their ability to resist drinking alcohol (Oei, Hasking, & Young, 2005). In other words, these expectancies reflect a person’s self-efficacy beliefs that they can refuse alcohol across different situations (Young, Oei, & Crook, 1991). In the present study, emotional relief drinking refusal expectancies regarding one’s ability to resist drinking alcohol when experiencing psychological distress were examined.

Drinking refusal expectancies are important to consider because it is possible that while some individuals may hold expectancies that drinking alcohol will result in tension reduction, they may also hold beliefs that they have the ability to resist drinking when experiencing distress. In other words, simply because an individual believes that alcohol has a tension reducing property may not guarantee that they will engage in alcohol use when experiencing distress secondary to their trauma symptoms. Instead, it is possible that PTSD-related distress is particularly likely to be associated with alcohol-related problems for individuals who believe that drinking relieves tension and who believe that they have little control over their drinking when experiencing such tension. This prediction is supported by existing research in the alcohol literature reporting that the combination of high positive alcohol outcome expectancies and low drinking refusal expectancies tends to be particularly associated with heavy drinking (Hasking & Oei, 2002; Lee, Oei, & Greeley, 1999; Morawska & Oei, 2005). Thus, to accurately understand how tension reduction
expectancies may serve as a vulnerability factor for PTSD-AUD comorbidity, it is crucial to consider how these expectancies are related to the confidence that an individual places in their ability to regulate their drinking when experiencing negative emotion.

Specific hypotheses of the present study include the following:

1. A larger positive relationship between PTSS and alcohol-related problems will be observed for males compared to females.

2. The larger positive relationship between PTSS and alcohol-related problems for males will be further qualified by the degree to which an individual reports using avoidance coping.

3. The larger positive relationship between PTSS and alcohol-related problems for males will be further qualified by the degree to which an individual reports holding tension reduction expectancies.

4. A larger positive relationship between PTSS and alcohol-related problems will be observed for individuals expressing greater beliefs in alcohol’s tension reducing properties and lower confidence in their ability to resist drinking alcohol when experiencing distress.
METHOD

Participants

Participants consisted of 1070 (65% female, 83% Caucasian) undergraduates enrolled in psychology courses at Kent State University who completed an online screening survey consisting of the Posttraumatic Diagnostic Scale (PDS: Foa, Cashman, Jaycox, & Perry, 1997) and the Alcohol Use Disorders Identification Test (AUDIT: Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). Participants were invited to complete an additional online survey if they reported experiencing at least 1 event in which they responded with intense fear, helpless, or horror to an experience involving actual or threatened harm to either themselves or someone else [i.e. Criterion A of the PTSD diagnosis] (APA, 2000). This inclusionary criterion was adopted to ensure that the trauma symptoms reported by participants were anchored to an event that would qualify as a trauma as defined in the DSM-IV. In order to provide temporal clarity to the research questions, participants were included if they reported experiencing a Criterion A index trauma that occurred at least 1-year ago. This criterion was adopted because participants were asked to report on drinking behavior that they engaged in during the last year; therefore, this ensured that the trauma preceded the drinking behavior reported.
In total, 247 individuals participating in the screener met these criteria. Of these, 153 completed the additional surveys associated with the study. However, 9 participants were removed due to inconsistent responses on the study’s questionnaires (i.e. reported never drinking on the AUDIT yet reported experiencing alcohol-related problems on the RAPI), resulting in a final sample of 144 (69% female, 84% Caucasian) included in the analyses reported here. Those included the final sample did not differ from non-included participants in terms of PTSS ($t_{[217.35]} = -0.90, p = 0.37$), sex $\chi^2[1, n = 245] = 1.33, p = 0.25$), age ($t_{[202.28]} = -0.77, p = 0.44$), race ($\chi^2[4, n = 243] = 4.97, p = 0.29$), or hazardous and harmful alcohol use as assessed by the AUDIT ($t_{[221.05]} = -0.65, p = 0.51$).

Procedure

Undergraduates enrolled in psychology courses at Kent State University regularly participate in research studies through an online data collection system (http://www.sona-systems.com/) in order to earn course credit. In the current study, consenting participants were presented with an online screener consisting of the Posttraumatic Diagnostic Scale (PDS: Foa, Cashman, Jaycox, & Perry, 1997) and the Alcohol Use Disorders Identification Test (AUDIT: Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). Participants meeting Criterion A were subsequently invited to participate in a second online survey consisting of the Rutgers Alcohol Problem Index (RAPI: White & Labouvie, 1989), the Comprehensive Effects of Alcohol Questionnaire (CEO-A: Fromme, Stroot, & Kaplan, 1993), the Drinking Refusal Self-Efficacy Questionnaire-Revised (DRSEQ-R:
Oei, Hasking, & Young, 2005), and the Brief Cope (Carver, 1997). All participants received 1 research credit towards their psychology course, and for those eligible to participate in the second online survey, 3 research credits were granted towards their psychology course.

Measures

Posttraumatic Stress Disorder (PTSD). PTSD was assessed with the Posttraumatic Diagnostic Scale (PDS: Foa, Cashman, Jaycox, & Perry, 1997). The PDS is a 49-item self-report instrument assessing all DSM-IV diagnostic criteria for PTSD. The PDS can be used to obtain both a continuous PTSD symptom (PTSS) severity score and a dichotomous PTSD diagnosis. In the current study, the PDS was used to determine if respondents had experienced a Criterion A event as defined in the DSM-IV (APA, 2000). In addition, the PDS was used to determine the frequency with which respondents experienced each of 17 symptoms in the past month corresponding to DSM-IV B, C, and D PTSD symptom clusters on a scale ranging from 0 (‘Not at all or only one time) to 3 (‘5 or more times a week/almost always). These ratings were used to yield a measure of continuous PTSS severity. Finally, the PDS was used to determine probable PTSD diagnosis according to the scoring rule described by Foa et. al. (1997). More specifically, participants were classified as having a probable PTSD diagnosis if they reported experiencing an event meeting Criterion A; if they reported at least 1 reexperiencing symptom, 3 avoidance symptoms, and 2 hyperarousal symptoms (symptom endorsement was defined as a rating of 1 or higher); if they reported experiencing these symptoms for
at least 1 month; and if they reported functional impairment in at least one domain of life (e.g. school, work, or family).

The psychometric properties of the PDS have been well established both in trauma-exposed populations (Foa et al., 1997; Foa, Riggs, Dancu, & Rothbaum, 1993) and in general psychiatric outpatient settings (Sheeran & Zimmerman, 2002). Additionally, in a recent analysis of several common PTSD assessment tools, the PDS was found to have strong convergent and discriminant validity, as well as strong diagnostic utility, when used to assess PTSD in college populations (Adkins, Weathers, McDevitt-Murphy, & Daniels, 2008). In the present study, Cronbach’s alpha was 0.80 for the reexperiencing subscale, 0.84 for the avoidance subscale, and 0.82 for the hyperarousal subscale.

**Alcohol Use Disorder (AUD).** Probable alcohol use disorder (AUD) was determined with the Alcohol Use Disorder Identification Test (AUDIT: Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). The AUDIT is a 10-item self-report measure with item content reflecting the conceptual domains of hazardous alcohol consumption (questions 1-3), alcohol dependence symptoms (questions 4-6), and alcohol-related problems reflecting harmful alcohol use (questions 7-10). For each item, respondents were asked to provide responses on a scale ranging from 0 to 4; however, the anchors associated with this scale varied depending upon the item in question. For example, question 2 asked respondents how many drinks they typically consumed, with a score of 0 corresponding to ‘1 to 2’ and a score of 4 corresponding to ’10 or more.’ On the other hand, question 7 asked how often respondents have experienced guilt or remorse
associated with drinking with a score of 0 corresponding to ‘Never’ and a score of 4 corresponding to ‘Daily or almost daily.’

The psychometric properties of the AUDIT have been examined in a variety of populations including college students, and it has been shown to offer superior identification of alcohol dependent individuals from this population compared to a variety of other alcohol screening instruments (Clements, 1998; Fleming, Barry, & MacDonald, 1991). In the original construction of the AUDIT, a cut score of 8 was found to yield good sensitivity and specificity for the identification of probable AUDs (Saunders, Aasland, Babor, De La Fuente, & Grant, 1993); however, research with college students suggests that a cut score of 6 to 8 offers better identification in this population (Kokotailo et. al., 2004). Thus, in the current study, scores on the AUDIT were summed and probable AUDs were determined using a cut score of 7. Cronbach’s alpha was 0.85 for the hazardous alcohol consumption items, 0.65 for the alcohol dependence symptoms items, and 0.69 for the alcohol-related problems items (overall alpha 0.85).

Alcohol-Related Problems. Alcohol-related problems were measured with the Rutgers Alcohol Problem Index (RAPI: White & Labouvie, 1989). The RAPI is a 23-item self-report instrument designed to assess problems related to alcohol use in adolescent and college student populations. The RAPI asks respondents to rate the frequency with which they have experienced 23 different problems in the past year while they were drinking or because of their drinking on a scale ranging from 0 (‘Never’) to 5 (‘More than 5 times’). Sample items include ‘Not able to do your homework or study for
a test’, ‘Went to work or school high or drunk’, and ‘Missed a day (or part of a day) of school or work’. Consistent with prior research utilizing the RAPI, two additional items ‘Drove shortly after having more than two drinks’ and ‘Drove shortly after having more than four drinks’ were also included (Neighbors, Larimer, Geisner, & Knee, 2004). Research examining the psychometric properties of the RAPI has demonstrated that the scale possesses good convergent validity and internal consistency (Ginzler, Garrett, Baer, & Peterson, 2007; Thomas & McCambridge, 2008). In the present study, Cronbach’s alpha was 0.94.

**Avoidance Coping (AVC).** Avoidance coping was measured using the Brief Cope (Carver, 1997). The Brief Cope is a 28-item measure assessing 14 dimensions of coping. Consistent with prior research, avoidance coping was measured by calculating the unweighted sum of the items comprising the self-distraction, denial, and behavioral disengagement subscales (Ullman, Filipas, Townsend, & Starzynski, 2007; Ullman, Townshend, Filipas, & Starzynski, 2007; Wong, Looney, Michaels, Palesh, & Koopman, 2006). Cronbach’s alpha was 0.51 for the self-distraction subscale, 0.76 for the denial subscale, and 0.41 for the behavioral disengagement subscale (overall alpha 0.49).

**Tension Reduction Expectancies (TRE).** Tension reduction alcohol outcome expectancies were assessed with the Comprehensive Effects of Alcohol Questionnaire (CEO-A: Fromme, Stroot, & Kaplan, 1993). The CEO-A is a 38-item self-report measure that asks respondents about the expected effects that consuming alcohol will have for them. For each item, participants were asked to rate the degree to which they agreed that the described effect would occur for them if they were to drink alcohol (1 =
‘Disagree’ to 4 = ‘Agree’). The CEO-A possesses 7 subscales reflecting expectancies that alcohol consumption will result in positive outcomes (i.e. the sociability, tension reduction, liquid courage, and sexuality subscales), as well as expectancies that alcohol consumption will result in negative outcomes (i.e. the cognitive/behavioral impairment, risk/aggression, and self-perception subscales). In the present study, the items reflecting tension reduction expectancies (i.e. ‘I would feel calm’, ‘I would feel peaceful’, ‘My body would feel relaxed’) were utilized to examine the study’s hypotheses. Prior research has established that the CEO-A is factorially valid, possesses good convergent validity, and is internally consistent (Fromme et al., 1993; Valdivia & Stewart, 2005). Cronbach’s alpha in the current study was 0.81.

**Emotional Relief Drinking Refusal Expectancies (ERDRE).** Emotional relief drinking refusal expectancies were measured with the Drinking Refusal Self-Efficacy Questionnaire-Revised (DRSEQ-R: Oei, Hasking, & Young, 2005). The DRSEQ-R is a 19-item measure that asks respondents to rate their confidence that they could resist drinking alcohol in a variety of situations. For each situation described, participants express their confidence on 6-point scale (1 = ‘I am very sure I could NOT resist drinking’ to 6 = ‘I am very sure I could resist drinking’). Factor analyses of the DRSEQ-R have revealed the presence of 3 factors reflecting social pressure, emotional relief, and opportunistic drinking situations (Oet et. al., 2005; Young, Hasking, Oei, & Loveday, 2007). The items reflecting emotional relief drinking refusal expectancies were examined in the current study. Cronbach’s alpha was 0.96 in the present study.
DATA ANALYSIS PLAN

All analyses were conducted using SPSS 16.0 for Windows (SPSS Inc., 2008). To test the applicability of the stressor vulnerability model to PTSD-AUD comorbidity, moderated multiple regression analyses were conducted in which PTSD symptoms (PTSS) served as the predictor, alcohol-related problems served as the outcome, and sex, AVC, TRE, and ERDRE served as moderators. Three regression models were evaluated. In models 1 and 2, the 2-way interaction between PTSS and sex was examined to determine the moderating role of sex on the relationship between PTSS and alcohol-related problems. Additionally, in model 1 the 3-way interaction between PTSS, sex, and AVC was tested to determine whether being male and relying on AVC was particularly likely to be associated with PTSS and alcohol-related problems. Further, in model 2, the 3-way interaction between PTSS, sex, and TRE was tested to assess whether being male and holding strong TRE was also particularly likely to be associated with PTSS and alcohol-related problems. Finally, in model 3, the 3-way interaction between PTSS, TRE, and ERDRE was examined to determine whether the relationship between PTSS and alcohol-related problems was stronger for individuals with higher levels of TRE and lower levels of ERDRE.
These moderation analyses were conducted within a regression framework given that the focal predictor (PTSS) and the moderators (sex, AVC, TRE, and ERDRE) were a mixture of continuous and dichotomous variables (Baron & Kenny, 1986). While it would have been possible to define the focal predictor as a dichotomous probable PTSD diagnosis, we chose to define it as a continuous variable given research suggesting that post-traumatic psychopathology is best represented as falling along a continuum (Stein, Walker, Hazen, & Forde, 1997; Marshall et. al., 2001). In addition, to ease interpretation of the results, all continuous predictors (i.e. PTSS, AVC, TRE and ERDRE) were standardized (i.e. z-transformed) prior to moderation analyses (Cohen, Cohen, West, & Aiken, 2003; Frazier, Tix, & Barron, 2004). Within regression, moderation is tested by first entering all lower-order effects – including the main effects of the moderator and independent variables, as well as any relevant 2-way interactions when a 3-way interaction is of interest. In the final step of the regression, the product term consisting of the moderator(s) and independent variable is entered. Moderation is said to be present when the product term is statistically significant over and above the lower-order effects (Cohen et. al., 2003).

If the product term accounted for a significant percentage of the variance in the outcome variable, several additional steps were taken in order to evaluate the form of the interaction. First, a graphical display of the interaction was constructed by computing the predicted value of the outcome at low (-1 SD), medium (0 SD), and high (+1 SD) values of the predictor, and at low (-1 SD) and high (+1 SD) values of the moderator (Cohen et. al., 2003). Second, using the web utility described by Preacher, Curran, & Bauer (2006),
all statistically significant interactions were further examined using *simple slope analyses* that tested which simple slopes statistically differed from zero. Unlike simply plotting the predicted values of the outcome based upon values of the predictor and outcome, simple slope analyses allow for precise statistical tests concerning how the predictor-outcome relationship may differ depending upon what values of the moderator(s) are considered (Frazier et. al., 2004).
RESULTS

Descriptive Statistics

Diagnostic frequencies, means, standard deviations, and zero-order correlations amongst the study variables are presented in Tables 1 and 2. Approximately 9.0% of all those participating in the online screener survey met criteria for a probable PTSD diagnosis as determined by the PDS, while approximately 39% met probable AUD criteria as determined by the AUDIT. Finally, approximately 5% met probable comorbid PTSD-AUD diagnostic criteria.

Moderated Multiple Regression

Results from models 1 and 2 examining the moderating effect of sex are reported in Tables 3 and 4. In step 1 of both models, greater PTSS were associated with greater alcohol-related problems as might be expected given the co-occurrence of PTSD and AUD. In addition, consistent with epidemiological data, being male was found to be associated with greater alcohol-related problems. When the product term representing the interaction between PTSS and sex was entered into the regression models in step 2, they were found to be statistically significant suggesting the presence of an interaction. Plots of predicted values and simple slope analyses suggested that a stronger positive PTSS-alcohol-related problems relationship was present for males (Model 1: \( b = 9.63, t [137] = 7.35, p < 0.001 \); Model 2: \( b = 9.00, t [137] = 1.45, p < 0.001 \)) compared to
Table 1. Frequencies for Probable PTSD, AUD, and PTSD-AUD Diagnoses

<table>
<thead>
<tr>
<th></th>
<th>Screener&lt;sup&gt;a&lt;/sup&gt; (N=1070)</th>
<th>Trauma 1-Yr Prior&lt;sup&gt;b&lt;/sup&gt; (N=144)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Probable PTSD</td>
<td>96</td>
<td>9.0%</td>
</tr>
<tr>
<td>Probable AUD</td>
<td>421</td>
<td>39.3%</td>
</tr>
<tr>
<td>Probable PTSD-AUD</td>
<td>55</td>
<td>5.1%</td>
</tr>
</tbody>
</table>

<sup>a</sup>Screener = denotes the group of participants who completed the online screener.  
<sup>b</sup>Trauma 1-Yr Prior = denotes participants who reported experiencing a criterion A event that occurred at least 1-year ago who participated in the main set of surveys.

Note. PTSD = posttraumatic stress disorder; AUD = alcohol use disorder; PTSD-AUD = posttraumatic stress disorder-alcohol use disorder
Table 2. Means, Standard Deviations, and Correlations Among the Major Study Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol Problems</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8.03</td>
<td>10.73</td>
</tr>
<tr>
<td>PTSS</td>
<td>0.48***</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8.11</td>
<td>8.71</td>
</tr>
<tr>
<td>Sex</td>
<td>-0.12</td>
<td>0.08</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TRE</td>
<td>0.20*</td>
<td>0.12</td>
<td>-0.09</td>
<td>1.00</td>
<td></td>
<td></td>
<td>8.78</td>
<td>2.33</td>
</tr>
<tr>
<td>AVC</td>
<td>0.19*</td>
<td>0.34***</td>
<td>0.16*</td>
<td>0.10</td>
<td>1.00</td>
<td></td>
<td>14.17</td>
<td>2.55</td>
</tr>
<tr>
<td>ERDRE</td>
<td>-0.54***</td>
<td>-0.47***</td>
<td>-0.04</td>
<td>-0.24**</td>
<td>-0.22**</td>
<td>1.00</td>
<td>35.87</td>
<td>8.05</td>
</tr>
</tbody>
</table>

Note. PTSS = posttraumatic stress symptoms; TRE = tension reduction alcohol outcome expectancies; AVC = avoidance coping; ERDRE = emotional relief drinking refusal expectancies. Sex was dummy coded such that a value of 0 = male and a value of 1 = female.

Trauma 1-Yr Prior (N=144)

Trauma 1-Yr Prior = denotes participants who reported experiencing a criterion A event that occurred at least 1-year ago who participated in the main set of surveys

*p < 0.05. **p < 0.01. ***p < 0.001
Table 3. *Summary of the Moderated Multiple Regression Analysis Examining the Interaction Between Sex, Avoidance Coping, and Posttraumatic Stress Symptoms on Alcohol-Related Problems*

<table>
<thead>
<tr>
<th>Step and Variables</th>
<th>B</th>
<th>SE B</th>
<th>95% CI</th>
<th>β</th>
<th>ΔR²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSS</td>
<td>5.10</td>
<td>0.83</td>
<td>3.46, 6.74</td>
<td>0.47***</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>-3.87</td>
<td>1.71</td>
<td>-7.25, -0.49</td>
<td>-0.17*</td>
<td></td>
</tr>
<tr>
<td>AVC</td>
<td>0.64</td>
<td>0.84</td>
<td>-1.01, 2.30</td>
<td>0.06</td>
<td>0.26***</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSS</td>
<td>9.63</td>
<td>1.31</td>
<td>7.04, 12.22</td>
<td>0.90***</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>-4.65</td>
<td>1.59</td>
<td>-7.79, -1.50</td>
<td>-0.20**</td>
<td></td>
</tr>
<tr>
<td>AVC</td>
<td>2.16</td>
<td>1.49</td>
<td>-0.78, 5.11</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>PTSS x Sex</td>
<td>-7.67</td>
<td>1.65</td>
<td>-10.94, -4.40</td>
<td>-0.58***</td>
<td></td>
</tr>
<tr>
<td>PTSS x AVC</td>
<td>1.50</td>
<td>0.89</td>
<td>-0.25, 3.26</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>Sex x AVC</td>
<td>-1.61</td>
<td>1.74</td>
<td>-5.05, 1.84</td>
<td>-0.13</td>
<td>0.13***</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSS</td>
<td>9.56</td>
<td>1.32</td>
<td>6.95, 12.16</td>
<td>0.89***</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>-4.14</td>
<td>1.71</td>
<td>-7.52, -0.77</td>
<td>-0.18*</td>
<td></td>
</tr>
<tr>
<td>AVC</td>
<td>2.18</td>
<td>1.49</td>
<td>-0.77, 5.12</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>PTSS x Sex</td>
<td>-7.34</td>
<td>1.70</td>
<td>-10.71, -3.97</td>
<td>-0.56***</td>
<td></td>
</tr>
<tr>
<td>PTSS x AVC</td>
<td>2.53</td>
<td>1.54</td>
<td>-0.51, 5.58</td>
<td>0.21</td>
<td></td>
</tr>
<tr>
<td>Sex x AVC</td>
<td>-1.69</td>
<td>1.75</td>
<td>-5.15, 1.76</td>
<td>-0.13</td>
<td></td>
</tr>
<tr>
<td>PTSS x Sex x AVC</td>
<td>-1.55</td>
<td>1.89</td>
<td>-5.27, 2.18</td>
<td>-0.11</td>
<td>0.003</td>
</tr>
</tbody>
</table>

*Note. PTSS = posttraumatic stress symptoms; AVC = avoidance coping. Sex was dummy coded such that a value of 0 = male and a value of 1 = female.

*Trauma 1-Yr Prior = denotes participants who reported experiencing a criterion A event that occurred at least 1-year ago who participated in the main set of surveys.

* p < 0.05. ** p < 0.01. *** p < 0.001
Table 4. *Summary of the Moderated Multiple Regression Analysis Examining the Interaction Between Sex, Tension Reduction Expectancies, and Posttraumatic Stress Symptoms on Alcohol-Related Problems*

<table>
<thead>
<tr>
<th>Step and Variables</th>
<th>$B$</th>
<th>$SE$ $B$</th>
<th>95% CI</th>
<th>$\beta$</th>
<th>$\Delta R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSS</td>
<td>5.13</td>
<td>0.78</td>
<td>3.59, 6.67</td>
<td>0.48***</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>-3.37</td>
<td>1.68</td>
<td>-6.70, -0.04</td>
<td>-0.14*</td>
<td></td>
</tr>
<tr>
<td>TRE</td>
<td>1.46</td>
<td>0.78</td>
<td>-0.08, 3.00</td>
<td>0.14</td>
<td>0.28***</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSS</td>
<td>9.00</td>
<td>1.45</td>
<td>6.13, 11.87</td>
<td>0.84***</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>-3.37</td>
<td>1.60</td>
<td>-6.54, -0.20</td>
<td>-0.14*</td>
<td></td>
</tr>
<tr>
<td>TRE</td>
<td>2.66</td>
<td>1.50</td>
<td>-0.32, 5.63</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>PTSS x Sex</td>
<td>-6.38</td>
<td>1.66</td>
<td>-9.67, -3.09</td>
<td>-0.48***</td>
<td></td>
</tr>
<tr>
<td>PTSS x TRE</td>
<td>1.20</td>
<td>0.94</td>
<td>-0.66, 3.07</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Sex x TRE</td>
<td>-1.50</td>
<td>1.69</td>
<td>-4.84, 1.83</td>
<td>-0.12</td>
<td>0.11***</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSS</td>
<td>5.79</td>
<td>2.01</td>
<td>1.82, 9.77</td>
<td>0.54**</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>-1.67</td>
<td>1.75</td>
<td>-5.13, 1.78</td>
<td>-0.07</td>
<td></td>
</tr>
<tr>
<td>TRE</td>
<td>4.86</td>
<td>1.77</td>
<td>1.36, 8.36</td>
<td>0.45**</td>
<td></td>
</tr>
<tr>
<td>PTSS x Sex</td>
<td>-3.06</td>
<td>2.19</td>
<td>-7.40, 1.27</td>
<td>-0.23</td>
<td></td>
</tr>
<tr>
<td>PTSS x TRE</td>
<td>5.68</td>
<td>2.18</td>
<td>1.37, 9.98</td>
<td>0.47*</td>
<td></td>
</tr>
<tr>
<td>Sex x TRE</td>
<td>-3.88</td>
<td>1.96</td>
<td>-7.77, 0.002</td>
<td>-0.31</td>
<td></td>
</tr>
<tr>
<td>PTSS x Sex x TRE</td>
<td>-5.47</td>
<td>2.41</td>
<td>-10.23, -0.71</td>
<td>-0.36*</td>
<td>0.02*</td>
</tr>
</tbody>
</table>

*Note. PTSS = posttraumatic stress symptoms; TRE = tension reduction alcohol outcome expectancies. Sex was dummy coded such that a value of 0 = male and a value of 1 = female.

*aTrauma 1-Yr Prior denotes participants who reported experiencing a criterion A event that occurred at least 1-year ago who participated in the main set of surveys.*

*p < 0.05. **p < 0.01. ***p < 0.001*
females (Model 1: $b = 1.96$, $t [137] = 1.90$, $p = 0.06$; Model 2: $b = 2.62$, $t [137] = 0.89$, $p = 0.004$) consistent with hypothesis 1 (see Figures 1 and 2).

When the product term representing the interaction between PTSS, sex, and AVC was entered into step 3 of model 1, it was found to be statistically non-significant, contrary to hypothesis 2 ($\beta = -0.11$, $p = 0.41$). However, the product term representing the PTSS x Sex x TRE interaction in model 2 was found to be significant ($\beta = -0.36$, $p = 0.02$). To understand the nature of this interaction, a plot of predicted values was constructed and simple slope analyses were performed. Consistent with hypothesis 3, the resulting graphical display and simple slope analyses revealed a larger positive relationship between PTSS and alcohol-related problems present for males reporting elevated levels of TRE ($b = 11.47$, $t [136] = 8.14$, $p = 0.001$) compared to males reporting lower levels of TRE ($b = 0.12$, $t [136] = 0.03$, $p = 0.98$), as well as females reporting either high ($b = 2.93$, $t [136] = 2.32$, $p = 0.02$) or low levels of TRE ($b = 2.52$, $t [136] = 1.76$, $p = 0.08$) (see Figure 3).

Results from model 3 examining the moderating effects of TRE and emotional relief drinking refusal expectancies (ERDRE) on the relationship between PTSS and alcohol-related problems are reported in Table 5. In step 1 of the model, greater levels of PTSS and lower levels of ERDRE each independently predicted alcohol-related problems. However, TRE failed to predict alcohol-related problems ($\beta = 0.08$, $p = 0.27$). When the product term representing the PTSS x TRE x ERDRE interaction was entered into step 3 of the model, it was found to be statistical significant ($\beta = -0.25$, $p = 0.04$).
Figure 1. *Plotted Means Illustrating Moderating Effect of Sex by Posttraumatic Stress Symptoms on Alcohol-Related Problems in Model 1 (N = 144).*

<table>
<thead>
<tr>
<th></th>
<th>LOW PTSS</th>
<th>MED PTSS</th>
<th>HIGH PTSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MALES</td>
<td>4.52</td>
<td>11.13</td>
<td>20.76</td>
</tr>
<tr>
<td>FEMALES</td>
<td>1.50</td>
<td>6.48</td>
<td>8.44</td>
</tr>
</tbody>
</table>

*Note*. PTSS = posttraumatic stress symptoms.

***p < 0.001
Figure 2. Plotted Means Illustrating Moderating Effect of Sex by Posttraumatic Stress Symptoms on Alcohol-Related Problems in Model 2 (N = 144).

Note. PTSS = posttraumatic stress symptoms.

** p < 0.01. *** p < 0.001
Figure 3. *Plotted Means Illustrating the Interaction Between Posttraumatic Stress Symptoms, Sex, and Tension Reduction Expectancies on Alcohol-Related Problems in Model 2 (N = 144).*

Note. PTSS = posttraumatic stress symptoms; TRE = tension reduction alcohol outcome expectancies

* p < 0.01. *** p < 0.001
To understand the nature of this interaction, a plot of predicted values were constructed and simple slope analyses were performed. These procedures revealed that the only statistically significant relationship existed for individuals with high TRE-low ERDRE. More specifically, for individuals expressing higher levels of tension reduction expectancies and lower confidence in their ability to resist drinking when distressed, the relationship between PTSS and alcohol-related problems was stronger such that greater PTSS was associated with greater alcohol-related problems ($b = 5.85, t [136] = 4.81, p < 0.001$) (see Figure 4). This pattern of results was not observed for any of the other simple slopes (high TRE-high ERDRE: $b = 2.77, t [136] = 1.61, p = 0.11$; low TRE-low ERDRE: $b = -1.85, t [136] = -0.75, p = 0.46$; low TRE-high ERDRE: $b = 2.19, t [136] = 1.19, p = 0.24$).
Table 5. Summary of the Moderated Multiple Regression Analysis Examining the Interaction Between Tension Reduction Expectancies, Emotional Relief Drinking Refusal Expectancies, and Posttraumatic Stress Symptoms on Alcohol-Related Problems

<table>
<thead>
<tr>
<th>Step and Variables</th>
<th>B</th>
<th>SE B</th>
<th>95% CI</th>
<th>β</th>
<th>ΔR²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSS</td>
<td>3.16</td>
<td>0.82</td>
<td>1.54, 4.79</td>
<td>0.29*</td>
<td></td>
</tr>
<tr>
<td>TRE</td>
<td>0.83</td>
<td>0.75</td>
<td>-0.64, 2.31</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>ERDRE</td>
<td>-4.07</td>
<td>0.84</td>
<td>-5.73, -2.40</td>
<td>-0.38***</td>
<td>0.36***</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSS</td>
<td>2.81</td>
<td>0.82</td>
<td>1.18, 4.44</td>
<td>0.26**</td>
<td></td>
</tr>
<tr>
<td>TRE</td>
<td>0.77</td>
<td>0.81</td>
<td>-0.82, 2.37</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>ERDRE</td>
<td>-3.69</td>
<td>0.94</td>
<td>-5.54, -1.82</td>
<td>-0.34***</td>
<td></td>
</tr>
<tr>
<td>PTSS x TRE</td>
<td>2.01</td>
<td>1.13</td>
<td>-0.23, 4.24</td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td>PTSS x ERDRE</td>
<td>-1.02</td>
<td>0.70</td>
<td>-2.41, 0.37</td>
<td>-0.13</td>
<td></td>
</tr>
<tr>
<td>TRE x ERDRE</td>
<td>1.94</td>
<td>1.06</td>
<td>-0.16, 4.04</td>
<td>0.16</td>
<td>0.04*</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSS</td>
<td>2.24</td>
<td>0.86</td>
<td>0.54, 3.93</td>
<td>0.21*</td>
<td></td>
</tr>
<tr>
<td>TRE</td>
<td>-0.07</td>
<td>0.89</td>
<td>-1.83, 1.69</td>
<td>-0.01</td>
<td></td>
</tr>
<tr>
<td>ERDRE</td>
<td>-4.16</td>
<td>0.96</td>
<td>-6.05, -2.27</td>
<td>-0.39***</td>
<td></td>
</tr>
<tr>
<td>PTSS x TRE</td>
<td>2.07</td>
<td>1.12</td>
<td>-0.14, 4.28</td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td>PTSS x ERDRE</td>
<td>0.24</td>
<td>0.91</td>
<td>-1.57, 2.04</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>TRE x ERDRE</td>
<td>2.70</td>
<td>1.11</td>
<td>0.50, 4.89</td>
<td>0.23*</td>
<td></td>
</tr>
<tr>
<td>PTSS x TRE x ERDRE</td>
<td>-1.78</td>
<td>0.84</td>
<td>-3.45, -0.12</td>
<td>-0.25*</td>
<td>0.02*</td>
</tr>
</tbody>
</table>

*Note. PTSS = posttraumatic stress symptoms; TRE = tension reduction alcohol outcome expectancies; ERDRE = emotional relief drinking refusal expectancies

Trauma 1-Yr Prior (N=144) denotes participants who reported experiencing a criterion A event that occurred at least 1-year ago who participated in the main set of surveys

*p < 0.05. **p < 0.01. ***p < 0.001
Figure 4. *Plotted Means Illustrating the Interaction Between Posttraumatic Stress Symptoms, Tension Reduction Expectancies, and Emotional Relief Drinking Refusal Expectancies on Alcohol-Related Problems in Model 3 (N = 144).*

Note. PTSS = posttraumatic stress symptoms; TRE = tension reduction alcohol outcome expectancies; ERDRE = emotional relief drinking refusal expectancies.

***p < 0.001
DISCUSSION

Posttraumatic stress disorder (PTSD) and alcohol use disorder (AUD) commonly co-occur yet research considering moderators that affect the co-occurrence of these disorders in younger populations is limited. The current study aimed to examine how vulnerability factors identified in the stressor vulnerability model may help to explain the relationship between PTSD symptoms (PTSS) and alcohol-related problems in undergraduate students. Results indicated that the relationship between PTSS and alcohol-related problems was stronger for males compared to females. This finding is consistent with studies reporting that the co-occurrence of PTSD and substance use disorders including alcohol use disorder are more common amongst men in the general population (Kessler et. al., 1995) and in psychiatric treatment seeking populations (Zlotnick, Zimmerman, Wolfsdorf, & Mattia, 2001). However, results from the current study also suggest that the relationship between PTSS and alcohol-related problems is particularly strong for males who hold strong beliefs in alcohol’s tension reducing properties, similar to existing research considering the stressor vulnerability model in the context of life stressors and alcohol consumption (Armeli et. al., 2000; Cooper et. al., 1992). Thus, results from the current study extend the stressor vulnerability model by suggesting that males with tension reduction expectancies are more likely to drink not only in response to life stressors, but also in response to traumatic stress.
Contrary to predictions, the interaction between sex and avoidance coping on the relationship between PTSS and alcohol-related problems was not found to be statistically significant. However, the low internal consistency observed in the subscales of the Brief COPE used to assess AVC render any conclusions regarding the limitations of applying the stressor vulnerability model to PTSD-AUD co-occurrence tenuous. The underlying factor structure of the Brief COPE has not been well articulated. Evidence exists suggesting that the items belonging to the self-distraction, denial, and behavioral disengagement subscales may not be best represented as belonging to the same factor. For example, it has been demonstrated that the items of the behavioral disengagement subscale may best be represented as their own factor, separate from the self-distraction and denial subscales which comprise their own factor (Kapsou, Panayiotou, Kokkinos, & Demetriou, 2010). In addition, other studies have documented that the items representing behavioral disengagement – the subscale with the worst internal consistency in the present study – each load highly onto separate factors (Miyazaki, Bodenhorn, Zalaquett, & Ng, 2008). Thus, the low internal consistency observed in the present study may signify that the Brief COPE is not the optimal way to operationalize avoidance coping. Furthermore, it should be noted that in the original studies testing the stressor vulnerability model in which an effect for avoidance coping was found (i.e. Cooper et. al., 1990; Cooper et. al., 1992), the Brief COPE was not used to measure this coping strategy. Rather, the Health and Daily Coping Responses Index was used (Moos, Cronkite, Billings, & Finney, 1986).
Results concerning the interaction between PTSS, tension reduction expectancies (TRE) and emotional relief drinking refusal expectancies (ERDRE) were consistent with predictions. More specifically, it was found that for individuals who held relatively strong beliefs that drinking alcohol relieves psychological distress – as well as relatively low confidence in their ability to resist drinking when experiencing tension – greater levels of PTSS were associated with greater alcohol-related problems. This finding is consistent with research in the alcohol use literature demonstrating that alcohol outcome expectancies and drinking refusal expectancies can better predict drinking behavior when considered in combination (Lee, Oei, & Greeley, 1999; Hasking & Oei, 2002).

According to Baldwin, Oei, & Young (1993), the decision to drink in a given situation depends upon how a person weighs the anticipated positive and negative effects of drinking alcohol (i.e. positive and negative alcohol outcome expectancies). Drinking refusal expectancies enter into this decision-making process by influencing whether a person feels that they can regulate their drinking in a given situation, given the anticipated benefits and negative consequences associated with drinking in that situation. According to this conceptualization, while alcohol outcome expectancies influence the decision to drink, it is ultimately a person’s beliefs concerning their ability to regulate their drinking that determine drinking behavior. This is consistent with the current finding demonstrating that amongst individuals with strong tension reduction expectancies, only those who expressed little confidence in their ability to resist drinking when experiencing distress reported elevated alcohol-related problems in conjunction with elevated PTSS.
Results from the present study also suggest that drinking refusal expectancies may be an important target when treating individuals experiencing trauma symptoms and alcohol problems. Role playing exercises in situations in which trauma cues and trauma-related symptoms are typically experienced, identification of alternative behaviors that could be performed instead of drinking when those cues and symptoms are encountered, and the successful application of those alternative behaviors during the role playing session would be useful components of an intervention designed to bolster confidence in one’s ability to resist drinking in response to trauma symptoms, thereby decreasing alcohol-related problems.

Several limitations were present in the current study. First, the outcome of interest consisted of alcohol-related problems relatively specific to college students that may be indicative of alcohol dependence symptoms. In addition, the DSM-IV-TR definition of AUD indicates that disorder is often characterized by both functional impairment – such as the alcohol-related problems measured in this study – and excessive alcohol consumption (APA, 2000). Thus, future research should include quantity-frequency measures of alcohol consumption as an outcome of interest, as well as measures of alcohol-related problems in order to fully test the model presented here. However, it should be noted that research examining the bivariate relationship between stress and alcohol (Cooper et. al. 1992; Laurent et. al., 1997) – including the relationship between PTSS and alcohol (Flood, McDevitt-Murphy, & Weathers, 2009) – suggests that this relationship is most likely to be observed when alcohol-related problems serve as the
outcome. This suggests that the outcome of interest in the current study was perhaps the most appropriate to use given the goals of the study.

Second, the cross-sectional nature of the current study limits the causal inferences that can be drawn. For example, the covariation between PTSS and alcohol-related problems is inferred to reflect the self-medication of trauma symptoms that precede the alcohol problems reported. However, since PTSS and alcohol-problems are reported concurrently, this inference is questionable. It should be noted that steps were taken to strengthen this inference. More specifically, participants reported experiencing traumatic events at least 1-year ago and reported on drinking behaviors during the prior year. Thus, PTSS reported were anchored to an event that preceded the alcohol-related problems reported. Even so, prospective study of the relationship between trauma and alcohol-related problems would increase confidence in the present findings..

Despite these limitations, the current study lends support to the idea that certain vulnerability factors may characterize younger individuals experiencing PTSS and alcohol-related problems, validating the applicability of the stressor vulnerability model to the co-occurrence of PTSD and AUD. Given that many of these vulnerability factors are modifiable, their identification as variables that make alcohol problems in response to PTSS more likely suggests that they may be effective targets in the reduction of alcohol use in younger individuals experiencing trauma symptoms.
REFERENCES


Coffey, S.F., Stasiewicz, P.R., Hughes, P.M., & Brimo, M.L. (2006). Trauma-focused


Flood, A.M., McDevitt-Murphy, M.E., Weathers, F.W., Eakin, D.E., & Benson, T.A.


Min, M., Farkas, K., Minnes, S., & Singer, L.T. (2007). Impact of childhood abuse and


collaborative project on early detection of persons with harmful alcohol consumption – II. *Addiction, 88*, 791-804.


