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Childhood Trauma, PTSD, and Problematic Alcohol and Substance Use in Low-income, African-American Men and Women

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Alcohol and substance use disorders confer significant burden to individuals, families, and broader social communities. At least 85,000 deaths in the United States in 2000 can be attributed to alcohol and another 17,000 to illicit substances (Mokdad, Marks, Stroup, & Gerberding, 2004), and alcohol alone accounts for 3.8% of global deaths and 4.6% of the global burden of disease and injury (Rehm, Mathers, Popova, Thavorncharoensap, Teerawattananon, & Patra, 2009). Alcohol and substance use disorders are associated with increased risk for a range of negative outcomes, including divorce, homelessness, partner and child abuse perpetration, psychiatric hospitalization, incarceration, and death by homicide and suicide (Collins, Ellickson, & Klein, 2007; Darke, Duflou, & Torok, 2009; Grinman et al., 2010; Klostermann & Fals-Stewart, 2006; Opsal, Kristensen, Larsen, Syversen, Rudshaug, Gerdner, & Clausen, 2013; Rehm et al., 2007; Slade, Stuart, Salkever, Karakus, Green, & Ialongo, 2008; Wells, 2009). Posttraumatic stress disorder (PTSD) is commonly comorbid with alcohol and substance use disorders (Swendsen et al., 2010) and is also associated with serious social, emotional, and physical dysfunction (Boarts, Sledjeski, Bogart, & Delahanty, 2006; Drescher, Rosen, Burling, & Foy, 2003; North & Smith, 1992; Taft, Pless, Stalans, Koenen, King, & King, 2005). Furthermore, comorbidity of PTSD with alcohol and substance use disorders is associated with greater negative psychosocial consequences relative to either alone (Dutton, Adams, Bujarski, Badour, & Feldner 2014; Mericle, Ta Park, Holck, & Arria, 2012).

The reasons for the observed comorbidity of PTSD with alcohol and substance use disorders are anything but certain, and the temporal relationship between the two remains murky, given that presentations may be similar and onsets difficult to separate. Nevertheless, a robust literature suggests that trauma (particularly early developmental trauma) and PTSD often precede the development of alcohol and substance abuse (Anda et al., 2006;

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Kilpatrick, Acierno, Saunders, Resnick, Best, & Schnurr, 2000; Molnar, Buka, & Kessler, 2001).

Early trauma may result in dysregulation of the stress response systems in a way that enhances vulnerability both to PTSD and to alcohol and substance use disorders (De Bellis, 2002). In a retrospective study of African-American women with current or recent cocaine abuse, the average age of first sexual assault was nine years old—at least eight years prior to average onset of alcohol or substance use and depression (Boyd, 1993). In a sample of African-American men with and without substance dependence, dependence was predicted by the interaction of child abuse with a particular polymorphism within GABRA2, a gene implicated in the development of alcohol and substance dependence, as well as PTSD, and whose expression is impacted by early life stress (Enoch, Hodgkinson, Yuan, Shen, Goldman, & Roy, 2010; Nelson et al., 2009). Furthermore, the potential impact of stress on substance use has been observed in translational studies, including those demonstrating that early stress (e.g., maternal separation, prolonged isolation) results in increased cocaine self-administration in rats (Kosten, Miserendino, & Kehoe, 2000; Meaney, Brake, & Gratton, 2002).

Moreover, the impact of early trauma on risk for developing alcohol and substance use problems is likely mediated by PTSD. In a retrospective study using path analysis, childhood rape was associated with PTSD and PTSD with alcohol use, but the direct path from childhood rape to alcohol use was not significant (Epstein, Saunders, Kilpatrick, & Resick, 1998). Moreover, in a longitudinal study, individuals with a history of exposure to trauma and a diagnosis of PTSD were at an increased risk for substance use disorder, but trauma alone did not increase risk (Chilcoat & Breslau, 1998). The authors proposed that the pattern of findings from this longitudinal study support the ‘self-medication’ hypothesis, whereby an individual is exposed to trauma, develops symptoms of PTSD, and uses substances as a means of reducing or dampening those symptoms.

Whether childhood trauma—through PTSD—is associated with risk for alcohol and substance use disorders in men and women differently remains unclear. Women are at greater risk of developing PTSD following traumatic exposure (Breslau, 2002; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995) and are more likely to develop PTSD prior to the onset of substance abuse (Sonnen, Back, Zuniga, Randall, & Brady, 2003), which could suggest a greater impact of PTSD on the risk for alcohol and/or substance abuse in women. On the other hand, other studies show that men with PTSD may be more likely than women with PTSD to use alcohol, in particular, to manage negative affect and negative cognitions (Chaplin, Hong, Bergquist, & Sinha, 2008; Jayawickreme, Yasinski, Williams, & Foa, 2012).

Incidence of comorbidity of PTSD and alcohol and/or substance abuse in men versus women could suggest a differential impact of PTSD on risk for alcohol or substance use—and thus on the potential mediating role of PTSD in the relationship of childhood trauma and alcohol and substance use. In a review, Najavits, Weiss, and Shaw (1997) suggest that the comorbidity between PTSD and substance use disorders is more common in women than in men, though studies included in the review provide limited support. In contrast, two large

epidemiological studies demonstrate increased comorbidity of PTSD and alcohol and substance use among men, relative to women (Regier, Narrow, & Rae, 1990; Kessler et al., 1995). Even so, in a nationally representative sample of adolescents, trauma was associated with increased risk for PTSD and substance use disorder comorbidity, but no effect of gender on risk for comorbidity was observed (Kilpatrick, Ruggiero, Acierno, Saunders, Resnick, & Best, 2003). Discrepancies of findings across studies may be due, at least in part, to methodological differences, such as the focus on one form of use disorder (e.g., alcohol abuse only or cocaine abuse only), on clinical vs. community samples, on different age groups, and on different racial/ethnic populations.

Importantly, African-American race is associated with less risk for substance use disorders, particularly when accounting for trauma (Kilpatrick et al. 2000; Kilpatrick et al., 2003), and other studies demonstrate increased alcohol abstinence in African-American men and women relative to white men and women (Caetano & Clark, 1998a and 1998b). Additionally, despite other studies demonstrating increased risk for comorbidity in men, in a sample of African-American men and women substance abusers, psychiatric histories were comparable (Lundy, Gottheil, Serota, Weinstein, & Sterling, 1995). These differences highlight an area for further exploration and needed replication. If alcohol or substance use is experienced differently among African Americans, patterns of comorbidity—even by gender—may also differ. Furthermore, few studies examine whether PTSD mediates the relationship between childhood trauma and alcohol or substance abuse for African Americans. Epstein et al.'s (1998) findings were based on a largely white (85%) sample, though Chilcoat and Breslau's (1998) study was drawn from a larger sample (Breslau, Davis, Andreski, & Peterson, 1991) with more African-American participants (41.75%). No study has examined whether for African Americans the mediating role of PTSD on the relationship between childhood trauma and alcohol or substance use differs for men and women.

The goal of the current study was to examine the relationships among childhood trauma, current PTSD symptom frequency, and current problematic alcohol and substance use in a largely low-income, African-American sample of adult men and women. We hypothesized that these four variables of interest (childhood trauma, PTSD, problematic alcohol use, and problematic substance use) would be positively correlated with each other, and, based on the larger epidemiological studies (Regier et al., 1990; Kessler et al., 1995), that men would be more likely than women to meet criteria for PTSD comorbid with problematic alcohol or substance use. Furthermore, based on previous studies (e.g., Chilcoat & Breslau, 1998), we hypothesized that PTSD would mediate the relationship between childhood trauma and problematic alcohol use and, separately, between childhood trauma and problematic substance use. Our focus on childhood trauma—rather than other types of trauma—is based on theoretical and empirical models of the impact of early trauma on risk for addiction (De Bellis, 2002; Enoch, 2010). Finally, although Chaplin et al. (2008) and Jayawickreme et al.'s (2012) findings did not include childhood trauma, we hypothesized, based on the their results showing a stronger relationship in men between both PTSD-related and general negative mood/cognition and alcohol cravings that gender would moderate the effect of PTSD on the relationship between childhood trauma and problematic alcohol and substance use, such that the indirect effect of PTSD would be stronger in men than in women.

Method

Participants and Procedure

Participants were adult individuals waiting in primary care, obstetrical–gynecological, and diabetes clinics of a large, public hospital in Atlanta, GA. Each participant was approached by a member of the research team and asked if s/he would be interested in study participation. Those who agreed to participate completed a battery of self-report measures, which took 45–75 minutes to complete (largely dependent on the extent of trauma history and symptoms). Due to variable literacy between subjects, all self-report measures were obtained by verbal interview. Each participant was paid USD\$15. Written and verbal informed consent was obtained for all participants, and all procedures were approved by the institutional review boards of Emory University School of Medicine and Grady Memorial Hospital. For a more detailed description of recruitment and method, see Gillespie et al. (2009).

Measures

Demographics—Participant demographics, including age, gender, self-identified race, and household monthly income were collected during the assessment.

The Childhood Trauma Questionnaire—(CTQ; Bernstein, Fink, Handelsman, & Foote, 1994; Bernstein et al., 2003) is a 28-item retrospective self-report questionnaire that measures frequency of five types of childhood trauma: physical abuse, sexual abuse, emotional abuse, physical neglect, and emotional neglect. Trauma frequency ratings are made on a five-point Likert scale: *never true*, *rarely true*, *sometimes true*, *often true*, and *always true*. Childhood trauma frequency was measured continuously, yielding a total childhood trauma score. The CTQ has demonstrated good reliability and validity in both clinical and community populations (Bernstein et al., 2003) as well as within the current population (Binder et al., 2008). Bernstein et al. (2003) found moderate levels of agreement between therapist observation ratings and CTQ scores (as high as .59 for physical abuse) and good internal consistency scores across a range of samples (physical abuse = 0.83–0.86, emotional abuse = 0.84–0.89, and sexual abuse = 0.92–0.95). In our sample, internal consistency scores were good (physical abuse = 0.81, physical neglect = 0.66, sexual abuse = 0.94, emotional abuse = 0.84, emotional neglect = 0.87). The CTQ has also demonstrated convergent validity in that CTQ scores significantly correlate with scores on the Childhood Trauma Interview (Bernstein et al., 1994).

The Modified PTSD Symptom Scale—(MPSS; Foa & Tolin, 2000; Schwartz, Bradley, Sexton, Sherry, & Ressler, 2005) is a 17-item self-report scale of current (past two weeks) symptoms of PTSD and includes a measure of both frequency and intensity of symptoms. The structure and content of the MPSS reflect the DSM-IV criteria for PTSD. Frequency items are rated on a 0 to 3 scale, with 0 indicating that a symptom is not present at all over the last two weeks and 3 indicating that the symptom has been experienced more than five times in a week. We summed the MPSS frequency items to obtain a continuous measure of PTSD symptom severity ranging from 0 to 51 (Ressler et al., 2011). We also created a categorical variable for presence/absence of current PTSD based on DSM-IV criterion

symptom clusters (Jovanovic et al., 2010). Both the continuous and categorical variables are based on frequency, and not intensity, of PTSD symptoms reported on the MPSS.

The Alcohol Use Disorders Identification Test—(AUDIT; Saunders, Aasland, Babor, & Grant, 1993) is a 10-item self-report screening instrument for problematic alcohol use occurring in the last year. Items on the AUDIT assess both consumption and consequences, and responses are coded on a 0 (*never*) to 4 (*daily or almost daily*) scale. The AUDIT is well-validated across multiple samples, ranging from the general public to psychiatric inpatients (Rubin, Migneault, Marks, Goldstein, Ludena, & Friedman, 2006; Bradley et al., 2003; Maisto, Carey, Carey, Gordon, & Gleason, 2000), demonstrating good validity and reliability ($\alpha = .83$) (Reinert & Allen, 2007), as well as good sensitivity (.90) and specificity (.70) when using a cutoff score of 8 out of the possible 40 (Maisto et al., 2000).

The Drug Abuse Screening Test-10—(DAST-10; Skinner, 1982) is a 10-item self-report screening measure for substance-abuse problems occurring in the last year. Like the AUDIT, items address both consumption and interpersonal and medical consequences but are coded as *yes/no*. The DAST-10 has performed well across several populations, including the general public and psychiatric outpatients and inpatients (El-Bassel et al., 1997; Cocco & Carey, 1998; Carey, Carey, & Chandra, 2003), demonstrating good validity and reliability ($\alpha = .86$), as well as sensitivity (.84) and specificity (.76) when using a cutoff score of 3 out of the possible 10 (Cocco & Carey, 1998).

Data Analysis

Initial analyses included independent *t*-tests comparing men and women on CTQ, MPSS, AUDIT, and DAST continuous total scores, as well as bivariate correlations among these scores. In addition, a Pearson's χ^2 examined categorically the rates of PTSD alone, alcohol and/or substance use problems alone, and PTSD comorbid with alcohol and/or substance use problems between men and women.

To examine whether PTSD symptoms mediate the relationship between childhood trauma and current problematic alcohol and substance use problems, and if those mediation effects vary as a function of gender, we planned two simple mediation analyses (one predicting AUDIT scores, the other predicting DAST scores) and two moderated mediation analyses (again, one predicting AUDIT scores, the other predicting DAST scores). These analyses were conducted using bootstrapping techniques based on recommendations by Preacher and Hayes (2008) and Preacher, Rucker, and Hayes (2007) using the PROCESS macro for SPSS version 22.0 developed by Hayes (2013; see <http://www.afhayes.com/introduction-to-mediation-moderation-and-conditional-process-analysis.html>). This approach does not assume normally distributed indirect effects, and for this and other reasons it is more powerful and more accurate in testing mediation than the commonly used Sobel test and causal steps approach (Zhao, Lynch, & Chen, 2010). For the simple mediation analyses (model 4 in PROCESS; Hayes, 2013b), the *a* path represents the path from childhood trauma to PTSD symptoms, and the *b* path represents the impact of the mediator, PTSD symptoms, on problematic alcohol use and problematic substance use. Path *c'* represents the direct effect of the impact of childhood trauma on problematic alcohol use and problematic

substance use when accounting for PTSD symptoms. We generated 5,000 bootstrap samples to yield a 95% bias-corrected confidence interval (CI) of the indirect effect $a \times b$ (i.e., the mediation effect). If the confidence interval for the indirect effect ($a \times b$) calculated by the bootstrap analysis does not include zero, the indirect effect is significant and mediation is established.

In the moderated mediation analyses (model 58 in PROCESS; Hayes, 2013b), we tested the moderating effect of gender on paths a and b , as well as the conditional indirect effect of PTSD on the relationship between childhood trauma and problematic alcohol and substance use at different levels of gender (i.e., men vs. women). As in the procedures described for simple mediation, if the confidence interval for an effect does not include zero, the moderation of the mediator is significant. The index of moderated mediation is calculated as $[a_1b_{2i} + a_3b_{1i} + a_3b_{2i}(2W + \delta)] \delta$, where W represents the dichotomous moderator and δ represents the difference between the two values of the moderator, in this case 0 and 1 for men and women, respectively (Hayes, 2014). See Figure 1 for the proposed moderated mediation model predicting problematic alcohol use. The proposed model for problematic substance use is identical.

Results

Participant Characteristics

The resulting sample of complete cases yielded 2887 participants (803 men, 2084 women). Relative to participants whose data were incomplete ($N = 8103$), participants in the current study were younger, $M = 39.55$, $SD = 13.41$ vs. $M = 40.17$, $SD = 13.96$, $t(5267.18) = 2.13$, $p < .05$. No differences were observed for gender, race, income, CTQ, MPSS, AUDIT, or DAST.

The majority of participants in the current study (92.86%) were African-American. Nearly a third (31.97%) of participants reported a household monthly income of less than USD\$500, over half (52.41%) reported incomes of \$500–1999, and the remaining 15.62% reported incomes of \$2000 or more. Relative to women, men in this sample were significantly older, $M = 44.25$, $SD = 12.25$ vs. $M = 37.73$, $SD = 13.39$, $t(1581.04) = 12.48$, $p < .001$.

Overall, women reported greater frequency of childhood trauma on the CTQ, $t(2880) = 5.74$, $p < .001$, and men reported more problematic alcohol use on the AUDIT, $t(1090.54) = 13.65$, $p < .001$, as well as higher problematic substance use on the DAST, $t(1181.36) = 8.72$, $p < .001$. Men and women did not differ in terms of self-reported PTSD symptoms. All variables were positively correlated with one another (see Table 1).

Comorbidity and Gender

Based on categorical MPSS, AUDIT, and DAST scores, 15.69% of participants reported problematic alcohol or substance use without PTSD, 19.26% reported PTSD alone, and 12.02% reported PTSD comorbid with problematic alcohol or substance use. We compared rates of comorbidity status (i.e., neither PTSD nor problematic alcohol and/or substance use, PTSD alone, problematic alcohol and/or substance use alone, and both PTSD and problematic alcohol and/or substance use) in men and women using Pearson's χ^2 and

comparing proportions by gender with Bonferroni corrections for p -values (see Table 2). Group differences were observed, $\chi^2(3) = 218.84, p < .001$. Women were more likely to meet criteria for neither and for PTSD alone, and men were more likely to meet criteria for problematic alcohol and/or substance use alone or for both.

Childhood Trauma, PTSD, and Problematic Alcohol Use

In a simple mediation analysis of the effect of childhood trauma on current problematic alcohol use via PTSD, we found that the indirect effect from the bootstrap analysis was positive and significant, $b = .036, SE = .004, 95\% \text{ CI } [.028, .044]$. The direct effect was also significant, $b = .022, SE = .008, 95\% \text{ CI } [.007, .037]$, and because the total effect was positive, $b = .060, SE = .007, 95\% \text{ CI } [.045, .071]$, this is a complementary mediation, per conventions established by Zhao et al. (2010). The size of the indirect effect, $\kappa^2 = .087, 95\% \text{ CI } [.069, .106]$, would be considered small to medium (see Preacher and Kelley, 2011).

We followed this simple mediation with a moderated mediation analysis (see Table 3). In examining path a (from the independent variable, CTQ, to the mediator, MPSS), we found a significant effect of childhood trauma in that as childhood trauma increased, PTSD symptom frequency increased. We also found a significant interaction of gender and childhood trauma in predicting PTSD so that the increase in childhood trauma was particularly predictive of PTSD increase for men. In examining path b (from the mediator, MPSS, to the dependent variable, AUDIT), we found effects of childhood trauma, gender, and PTSD. Higher childhood trauma, male gender, and higher PTSD symptom frequency predicted increased problematic alcohol use. A significant interaction of gender and PTSD in predicting problematic alcohol use was also observed, demonstrating that the increase in PTSD was particularly predictive of problematic alcohol use for men. Results demonstrated that the conditional indirect effect of PTSD at different levels of gender (i.e., the index of moderated mediation) was significant, $b = -.024, SE = .011, 95\% \text{ CI } [-.046, -.004]$ such that, although PTSD was a significant mediator of the relationship between childhood trauma and problematic alcohol use for both men and women, this mediation effect was stronger in men.

Childhood Trauma, PTSD, and Problematic Substance Use

In a simple mediation analysis of the effect of childhood trauma on current problematic substance use via PTSD, we found that the indirect effect from the bootstrap analysis was positive and significant, $b = .009, SE = .001, 95\% \text{ CI } [.007, .012]$. The direct effect was also significant, $b = .010, SE = .002, 95\% \text{ CI } [.006, .014]$, and because the total effect was positive, $b = .019, SE = .002, 95\% \text{ CI } [.016, .023]$, this is a complementary mediation. The size of the indirect effect, $\kappa^2 = .079, 95\% \text{ CI } [.010, .098]$, would be considered small to medium.

We followed this simple mediation with a moderated mediation analysis (see Table 4). Because both the predictors (CTQ, participant gender, and the interaction of CTQ and participant gender) and outcome (MPSS) were the same as in the first step of the previous moderated mediation analysis, the results were identical, so we again found a significant effect of childhood trauma a significant interaction of gender and childhood trauma in predicting PTSD. In examining path b (from the mediator, MPSS, to the dependent variable,

DAST), we found effects of childhood trauma, gender, and PTSD. Higher childhood trauma, male gender, and higher PTSD symptom frequency predicted increased problematic substance use. A significant interaction of gender and PTSD in predicting problematic substance use was also observed, demonstrating that the increase in PTSD was particularly predictive of problematic substance use for men. Like for problematic alcohol use, the index of moderated mediation was significant, $b = -.006$, $SE = .003$, 95% CI $[-.013, -.0001]$, such that PTSD is a significant mediator of the relationship between childhood trauma and problematic substance use for both men and women, but the mediation effect was, again, stronger in men.

Discussion

In our sample of primarily low-income, African-American participants recruited from outpatient primary care, diabetes, and OB/GYN clinics of an urban public hospital, we found that men were significantly more likely than women to report PTSD comorbid with problematic alcohol and/or substance use. Furthermore, we found that childhood trauma had a direct effect on current problematic alcohol use, as well as on current problematic substance use, but PTSD had a significant indirect effect on both of those relationships. For both alcohol and substance use, the indirect effect of PTSD was significant for men and women, but the effect was significantly greater for men.

As expected, women in this sample were less likely than men to report problematic alcohol or substance use, which is consistent with existing literature suggesting that men are at greater risk for alcohol and substance use disorders, regardless of PTSD (Grant, Dawson, Stinson, Chou, Dufour, & Pickering, 2004; Swendsen, Burstein, Case, Conway, Dierker, He, & Merikangas, 2012). Contrary to our expectations and previous research (Kessler et al., 1995; Breslau, 2002), PTSD symptom frequency was comparable for men and women; however, when separating out comorbid vs. non-comorbid PTSD, we found that, although overall PTSD symptoms were comparable, PTSD in men was more likely to be accompanied by problematic alcohol and/or substance use, which is consistent with other research (Regier et al., 1990; Kessler et al., 1995).

The reasons for the increased comorbidity in men are several, including that men may be more likely in general to abuse alcohol and substances (Grant et al. 2004; Swendsen et al., 2012), to use alcohol and substances to manage negative affect and negative cognitions (Chaplin et al., 2008; Jayawickreme et al., 2012), and to experience more stigma regarding mental health problems (Eisenberg, Downs, Golberstein, & Zivin, 2009). It is also possible that women in this sample experience more disincentives to abuse alcohol or substances. For example, relative to African-American men, African-American women are twice as likely to be caregivers to children (Lundy et al., 1995) and are ten times more likely than white women to be reported to child protective services for similar rates of substance use (Chasnoff, Landress, & Barrett, 1990). Poor mothers in general are more likely to be reported, as well (Chasnoff et al., 1990). This might suggest that for poor, African-American women, the consequences of abusing alcohol or substances are more substantial, and thus these women are more likely to avoid abusing alcohol and substances. It is also possible, however, that for the same reasons, these women were more motivated to underreport use.

As hypothesized and supported by previous research (e.g., Epstein et al., 1998), PTSD symptoms partly explained the relationship between childhood trauma and problematic alcohol use, as well as between childhood trauma and problematic substance use. For both simple mediation analyses, results supported a complementary mediation, per conventions established by Zhao et al. (2010). The concept of a complementary mediation overlaps with (but is not perfectly analogous to) Baron and Kenny's (1986) partial mediation, as both the indirect and direct effects were significant in the model. The direct effects of childhood trauma on problematic alcohol use and problematic substance use were still significant after accounting for the mediator. Early developmental trauma is associated with a range of permanent physiological changes—including alterations in dopamine reward pathways—that increase the risk for later addiction (Enoch, 2010), and such early trauma may also simultaneously result in increased negative affect and dysregulation of the stress response system associated with PTSD (De Bellis, 2002). In other words, although childhood trauma can independently increase risk for addiction, as PTSD symptoms manifest, the self-medicating effects of alcohol and substances may become even more rewarding (e.g., decreased negative mood with alcohol, attenuated startle response with cocaine, decreased insomnia and nightmares with marijuana; Cameron, Watson, & Robinson, 2014; Davis, Jovanovic, Norrholm, Glover, Swanson, Spann, & Bradley, 2013; Waldrop, Back, Verduin, & Brady, 2007), further increasing that risk for addiction.

That gender moderated the indirect effect of PTSD on the relationship between childhood trauma and problematic alcohol use, as well as problematic substance use, is interesting given the findings of Jayawickreme et al. (2012) that alcohol cravings were more strongly associated with PTSD-related negative cognitions about the self and the world for men than for women in an outpatient clinical sample, possibly suggesting a greater tendency toward self-medication in men than in women. Chaplin et al. (2008) proposed that the relatively greater association between alcohol cravings and stress in men may a result of greater pairing of reward and stress systems in men. Back, Brady, Jackson, Salstrom, and Zinzow (2005), however, found that men were more likely than women to use cocaine in pleasant situations, and women were more likely to report cocaine cravings in response to subjective distress. Though these studies provide an excellent framework for understanding the path from PTSD or general distress to alcohol and substance use disorders, they do not account for childhood trauma in their findings. Given the findings of the current study that childhood trauma has a direct impact on risk for problematic alcohol and substance use, future studies on the relationships between alcohol and substance use and PTSD (as well as other trauma-related psychopathology, such as depression), should consider including childhood trauma—potentially upstream to both PTSD and alcohol and substance use.

Findings in the current study point to an opportunity for further exploration: Is the effect of gender on the explanatory power of PTSD on the relationship between early trauma and alcohol and substance use more important for African Americans, or can these findings be replicated in other samples of varying racial/ethnic composition? It is important to keep in mind, however, that the current sample is likely not representative of African Americans as a whole if one considers the low income and high childhood trauma reported by participants in this sample. In fact, CTQ total scores in our sample were significantly higher than in Scher, Stein, Asmundson, McCreary, and Forde's (2001) normative community sample for

both men, $t(1261) = 8.14, p < .001$, and women, $t(2593) = 11.52, p < .001$, suggesting a disproportionate burden of childhood trauma in this sample relative to the population at large. Thus, future studies will better address the question of replicability.

The findings of the current study should be considered in light of several other important limitations. All of our results are based on self-report, which may result in bias in underreporting childhood trauma (Widom & Morris, 1997). Self-report bias is also very likely when reporting behaviors considered socially inappropriate or illegal, such as the use of alcohol or illegal substances (Magura & Kang, 1996). Furthermore, because these data are cross-sectional, we cannot assume causality or temporal precedence for any variable. Additionally, we did not separate out types of childhood trauma in our analyses, meaning that we could have missed important effects of specific trauma type within our models (Hyman, Garcia, & Sinha, 2006). Similarly, we examined substances as a whole, making it impossible to examine the effects of childhood trauma and PTSD on risk for problems with specific substances.

Despite these limitations, this study demonstrated a number of strengths. Findings from our predominantly low-income, African-American sample were similar to findings from other studies demonstrating that PTSD mediates the relationship between childhood trauma and alcohol and substance use disorders (Chilcoat & Breslau, 1998; Epstein et al., 1998). Our study also extended those findings by focusing on the moderating role of gender in those relationships. By including both men and women and both alcohol and substance use, we allowed for consideration of different findings across models within the same sample.

Importantly, because the participants in this study were recruited from primary care, diabetes, and OB/GYN clinic waiting areas—rather than mental health clinics—these findings underscore the importance of routine clinical assessments of mental health in general medical settings. African-American and low-income individuals are more likely, relative to white and higher-income individuals, to discuss emotional distress or seek mental health treatment in general medical settings, such as primary care clinics, rather than traditional mental health settings (Cooper-Patrick, Gallo, Powe, Steinwachs, Eaton, & Ford, 1999; Leaf, Livingston, Tischler, Weissman, Holzer, & Myers, 1985). At the same time, in primary care settings, African Americans and men are more likely to have a mental health problem that is undetected by their healthcare providers (Borowsky, Rubenstein, Meredith, Camp, Jackson-Triche, & Wells, 2000). Given the high rate of self-reported childhood trauma, PTSD, and alcohol and substance use problems in this sample—and considering the associated health-related consequences (e.g., Mokdad et al., 2004; Boarts et al., 2006; Walker, Gelfand, Katon, Koss, Von Korff, Bernstein, & Russo, 1999; Felitti et al., 1998)—providers should consider including trauma history and mental health screenings as part of routine medical appointments. In addition, health professionals in both general medical settings and traditional mental health settings should consider the possibility of childhood trauma histories and mental health comorbidities when making decisions about diagnoses and treatment planning. Both men and women with comorbid PTSD and alcohol and/or substance use disorder may benefit from integrated treatments that recognize the interplay of PTSD and addiction (Najavits, Schmitz, Gotthardt, & Weiss, 2005; Najavits, Weiss, Shaw, & Muenz, 1998).

This study contributes to a robust literature demonstrating the negative mental health consequences of childhood trauma, as well as a growing literature demonstrating that PTSD mediates the relationship between trauma and addiction. In this sample of largely low-income, African-American men and women with high self-reported childhood trauma, PTSD significantly mediated the relationship between childhood trauma and problematic alcohol use and between childhood trauma and problematic substance use, and both effects were greater for men than for women. Regardless of the effect of PTSD, childhood trauma was still directly related to both alcohol and substance use problems for both men and women.

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References

- Anda RF, Felitti VJ, Bremner JD, Walker JD, Whitfield CH, Perry BD, Giles WH. The enduring effects of abuse and related adverse experiences in childhood. *European Archives of Psychiatry and Clinical Neuroscience*. 2006; 256:174–186. [PubMed: 16311898]
- Back SE, Brady KT, Jackson JL, Salstrom S, Zinzow H. Gender differences in stress reactivity among cocaine-dependent individuals. *Psychopharmacology*. 2005; 180(1):169–176. [PubMed: 15682303]
- Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*. 1986; 51:1173. [PubMed: 3806354]
- Becker JB, Hu M. Sex differences in drug abuse. *Frontiers in Neuroendocrinology*. 2008; 29:36–47. [PubMed: 17904621]
- Bernstein DP, Fink L, Handelsman L, Foote J. Initial reliability and validity of a new retrospective measure of child abuse and neglect. *American Journal of Psychiatry*. 1994
- Bernstein DP, Stein JA, Newcomb MD, Walker E, Pogge D, Ahluvalia T, Desmond D. Development and validation of a brief screening version of the Childhood Trauma Questionnaire. *Child Abuse & Neglect*. 2003; 27:169–190. [PubMed: 12615092]
- Binder EB, Bradley RG, Liu W, Epstein MP, Deveau TC, Mercer KB, Ressler KJ. Association of FKBP5 polymorphisms and childhood abuse with risk of posttraumatic stress disorder symptoms in adults. *Journal of the American Medical Association*. 2008; 299:1291–1305. [PubMed: 18349090]
- Boarts JM, Sledjeski EM, Bogart LM, Delahanty DL. The differential impact of PTSD and depression on HIV disease markers and adherence to HAART in people living with HIV. *AIDS and Behavior*. 2006; 10:253–261. [PubMed: 16482405]
- Boyd CJ. The antecedents of women's crack cocaine abuse: Family substance abuse, sexual abuse, depression and illicit drug use. *Journal of Substance Abuse Treatment*. 1993; 10:433–438. [PubMed: 8246316]
- Bradley KA, Bush KR, Epler AJ, Dobie DJ, Davis TM, Sporleder JL, Kivlahan DR. Two brief alcohol-screening tests from the Alcohol Use Disorders Identification Test (AUDIT): validation in a female Veterans Affairs patient population. *Archives of Internal Medicine*. 2003; 163:821. [PubMed: 12695273]
- Brady KT, Back SE, Coffey SF. Substance abuse and posttraumatic stress disorder. *Current Directions in Psychological Science*. 2004; 13:206–209.
- Brecht ML, O'Brien A, Von Mayrhauser C, Anglin MD. Methamphetamine use behaviors and gender differences. *Addictive Behaviors*. 2004; 29:89–106. [PubMed: 14667423]
- Breslau N. In Review. *Canadian Journal of Psychiatry*. 2002; 47:923–929.

- Breslau N, Davis GC, Andreski P, Peterson E. Traumatic events and posttraumatic stress disorder in an urban population of young adults. *Archives of General Psychiatry*. 1991; 48(3):216–222. [PubMed: 1996917]
- Borowsky SJ, Rubenstein LV, Meredith LS, Camp P, Jackson-Triche M, Wells KB. Who is at risk for nondetection of mental health problems in primary care? *Journal of General Internal Medicine*. 2000; 15:318–388.
- Cameron C, Watson D, Robinson J. Use of a Synthetic Cannabinoid in a Correctional Population for Posttraumatic Stress Disorder-Related Insomnia and Nightmares, Chronic Pain, Harm Reduction, and Other Indications: A Retrospective Evaluation. *Journal of clinical psychopharmacology*. 2014; 34:559. [PubMed: 24987795]
- Carey KB, Carey MP, Chandra PS. Psychometric evaluation of the alcohol use disorders identification test and short drug abuse screening test with psychiatric patients in India. *The Journal of Clinical Psychiatry*. 2003; 64:767–774. [PubMed: 12934976]
- Caetano R, Clark CL. Trends in drinking patterns among whites, black, and Hispanics: 1984–1995. *Journal of Studies on Alcohol*. 1998a; 59:659–668. [PubMed: 9811087]
- Caetano, R.; Clark, CL. Trends in Situational Norms and Attitudes Toward Drinking Among Whites, Blacks, and Hispanics: 1984–1995. Berkeley: Alcohol Research Group; 1998b. 1998.
- Chaplin TM, Hong K, Bergquist K, Sinha R. Gender differences in response to emotional stress: An assessment across subjective, behavioral, and physiological domains and relations to alcohol craving. *Alcoholism: Clinical and Experimental Research*. 2008; 32:1242–1250.
- Chasnoff IJ, Landress HJ, Barrett ME. The prevalence of illicit-drug or alcohol use during pregnancy and discrepancies in mandatory reporting in Pinellas County, Florida. *The New England Journal of Medicine*. 1990; 322:1202–1206. [PubMed: 2325711]
- Chilcoat HD, Breslau N. Investigations of causal pathways between PTSD and drug use disorders. *Addictive Behaviors*. 1998; 23(6):827–840. [PubMed: 9801719]
- Cocco KM, Carey KB. Psychometric properties of the Drug Abuse Screening Test in psychiatric outpatients. *Psychological Assessment*. 1998; 10:408.
- Cohen, J. *Statistical Power Analysis for the behavioral Sciences*. 2nd ed.. New York, NY: Academic Press; 1988.
- Collins RL, Ellickson PL, Klein DJ. The role of substance use in young adult divorce. *Addiction*. 2007; 102:786–794. [PubMed: 17493107]
- Cooper-Patrick L, Gallo JJ, Powe NR, Steinwachs DM, Eaton WW, Ford DE. Mental health service utilization by African Americans and Whites: the Baltimore epidemiologic catchment area follow-up. *Medical Care*. 1999; 37:1034. [PubMed: 10524370]
- Darke S, Duflou J, Torok M. Drugs and violent death: comparative toxicology of homicide and non-substance toxicity suicide victims. *Addiction*. 2009; 104:1000–1005. [PubMed: 19466923]
- Davis TA, Jovanovic T, Norrholm SD, Glover EM, Swanson M, Spann S, Bradley B. Substance use attenuates physiological responses associated with PTSD among individuals with co-morbid PTSD and SUDs. *Journal of psychology & psychotherapy*. 2013
- De Bellis MD. Developmental traumatology: a contributory mechanism for alcohol and substance use disorders. *Psychoneuroendocrinology*. 2002; 27:155–170. [PubMed: 11750776]
- Drescher KD, Rosen CS, Burling TA, Foy DW. Causes of death among male veterans who received residential treatment for PTSD. *Journal of Traumatic Stress*. 2003; 16:535–543. [PubMed: 14690350]
- Dutton CE, Adams T, Bujarski S, Badour CL, Feldner MT. Posttraumatic stress disorder and alcohol dependence: Individual and combined associations with social network problems. *Journal of Anxiety Disorders*. 2014; 28:67–74. [PubMed: 24462749]
- Eisenberg D, Downs MF, Golberstein E, Zivin K. Stigma and help seeking for mental health among college students. *Medical Care Research and Review*. 2009; 66(5):522–541. [PubMed: 19454625]
- el-Bassel N, Schilling RF, Irwin KL, Faruque S, Gilbert L, Von Bargen J, Serrano Y, Edlin BR. Sex trading and psychological distress among women recruited from the streets of Harlem. *American Journal of Public Health*. 1997; 87:66–70. [PubMed: 9065229]

- Enoch MA, Hodgkinson CA, Yuan Q, Shen PH, Goldman D, Roy A. The influence of *GABRA2*, childhood trauma, and their interaction on alcohol, heroin, and cocaine dependence. *Biological Psychiatry*. 2010; 67:20–27. [PubMed: 19833324]
- Epstein JN, Saunders BE, Kilpatrick DG, Resnick HS. PTSD as a mediator between childhood rape and alcohol use in adult women. *Child Abuse & Neglect*. 1998; 22:223–234. [PubMed: 9589176]
- Felitti MD, Vincent J, Anda MD, Robert F, Nordenberg MD, Williamson MS, James S. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The Adverse Childhood Experiences (ACE) Study. *American journal of preventive medicine*. 1998; 14:245–258. [PubMed: 9635069]
- Foa EB, Tolin DF. Comparison of the PTSD Symptom Scale-interview version and the Clinician-administered PTSD scale. *Journal of Traumatic Stress*. 2000; 13:181–191. [PubMed: 10838669]
- Fraser GA. The Use of a Synthetic Cannabinoid in the Management of Treatment-Resistant Nightmares in Posttraumatic Stress Disorder (PTSD). *CNS Neuroscience & Therapeutics*. 2009; 15(1):84–88. [PubMed: 19228182]
- Gillespie CF, Bradley B, Mercer K, Smith AK, Conneely K, Gapen M, Ressler KJ. Trauma exposure and stress-related disorders in inner city primary care patients. *General Hospital Psychiatry*. 2009; 31:505–514. [PubMed: 19892208]
- Grinman MN, Chiu S, Redelmeier DA, Levinson W, Kiss A, Tolomiczenko G, Hwang SW. Drug problems among homeless individuals in Toronto, Canada: prevalence, drugs of choice, and relation to health status. *BMC Public Health*. 2010; 10:94. [PubMed: 20181248]
- Grant BF, Dawson DA, Stinson FS, Chou SP, Dufour MC, Pickering RP. The 12-month prevalence and trends in DSM-IV alcohol abuse and dependence: United States, 1991–1992 and 2001–2002. *Drug and Alcohol Dependence*. 2004; 74:223–234. [PubMed: 15194200]
- Hayes, AF. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. New York: Guilford; 2013a.
- Hayes, AF. Model templates for PROCESS for SPSS and SAS. 2013b. Retrieved from <http://www.afhayes.com/public/templates.pdf>
- Hayes, AF. Supplementary PROCESS documentation for Appendix A for *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. 2014. Retrieved from <http://www.afhayes.com/public/docaddendum.pdf>
- Hyman SM, Garcia M, Sinha R. Gender specific associations between types of childhood maltreatment and the onset, escalation, and severity of substance use in cocaine dependent adults. *American Journal of Drug and Alcohol Abuse*. 2006; 32:655–664. [PubMed: 17127554]
- Jayawickreme N, Yasinski C, Williams M, Foa EB. Gender-specific associations between trauma cognitions, alcohol cravings, and alcohol-related consequences in individuals with comorbid PTSD and alcohol dependence. *Psychology of Addictive Behaviors*. 2012; 26:13. [PubMed: 21480680]
- Jovanovic T, Norrholm SD, Blanding NQ, Davis M, Duncan E, Bradley B, Ressler KJ. Impaired fear inhibition is a biomarker of PTSD but not depression. *Depression and Anxiety*. 2010; 27:244–251. [PubMed: 20143428]
- Kessler RC, Sonnega A, Bromet E, Hughes M, Nelson CB. Posttraumatic stress disorder in the National Comorbidity Survey. *Archives of General Psychiatry*. 1995; 52:1048–1060. [PubMed: 7492257]
- Kilpatrick DG, Acierno R, Saunders B, Resnick HS, Best CL, Schnurr PP. Risk factors for adolescent substance abuse and dependence: data from a national sample. *Journal of Consulting and Clinical Psychology*. 2000; 68:19. [PubMed: 10710837]
- Kilpatrick DG, Ruggiero KJ, Acierno R, Saunders BE, Resnick HS, Best CL. Violence and risk of PTSD, major depression, substance abuse/dependence, and comorbidity: Results from the National Survey of Adolescents. *Journal of Consulting and Clinical Psychology*. 2003; 71:692. [PubMed: 12924674]
- Klostermann KC, Fals-Stewart W. Intimate partner violence and alcohol use: Exploring the role of drinking in partner violence and its implications for intervention. *Aggression and Violent Behavior*. 2006; 11:587–597.

- Kosten TA, Miserendino MJ, Kehoe P. Enhanced acquisition of cocaine self-administration in adult rats with neonatal isolation stress experience. *Brain Research*. 2000; 875:44–50. [PubMed: 10967297]
- Leaf PJ, Livingston MM, Tischler GL, Weissman MM, Holzer CE III, Myers JK. Contact with health professionals for the treatment of psychiatric and emotional problems. *Medical Care*. 1985;1322–1337. [PubMed: 4087948]
- Lundy A, Gottheil E, Serota R, Weinstein S, Sterling R. Gender differences and similarities in African-American crack cocaine abusers. *Journal of Nervous and Mental Disease*. 1995; 183:260–266. [PubMed: 7714515]
- Lynch WJ, Carroll ME. Sex differences in the acquisition of intravenously self-administered cocaine and heroin in rats. *Psychopharmacology*. 1999; 144:77–82. [PubMed: 10379627]
- Magura S, Kang SY. Validity of self-reported drug use in high risk populations: a meta-analytical review. *Substance Use & Misuse*. 1996; 31:1131–1153. [PubMed: 8853234]
- Maisto SA, Carey MP, Carey KB, Gordon CM, Gleason JR. Use of the AUDIT and the DAST-10 to identify alcohol and drug use disorders among adults with a severe and persistent mental illness. *Psychological Assessment*. 2000; 12:186. [PubMed: 10887764]
- Meaney MJ, Brake W, Gratton A. Environmental regulation of the development of mesolimbic dopamine systems: a neurobiological mechanism for vulnerability to drug abuse? *Psychoneuroendocrinology*. 2002; 27:127–138. [PubMed: 11750774]
- Mericle AA, Ta Park VM, Holck P, Arria AM. Prevalence, patterns, and correlates of co-occurring substance use and mental disorders in the United States: variations by race/ethnicity. *Comprehensive Psychiatry*. 2012; 53:657–665. [PubMed: 22152496]
- Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. *Journal of the American Medical Association*. 2004; 291:1238–1245. [PubMed: 15010446]
- Molnar BE, Buka SL, Kessler RC. Child sexual abuse and subsequent psychopathology: results from the National Comorbidity Survey. *American Journal of Public Health*. 2001; 91:753. [PubMed: 11344883]
- Nelson EC, Agrawal A, Pergadia ML, Lynskey MT, Todorov AA, Wang JC, Madden PA. Association of childhood trauma exposure and GABRA2 polymorphisms with risk of posttraumatic stress disorder in adults. *Molecular Psychiatry*. 2009; 14:234. [PubMed: 19229201]
- Najavits LM, Schmitz M, Gotthardt S, Weiss RD. Seeking safety plus exposure therapy: An outcome study on dual diagnosis men. *Journal of Psychoactive Drugs*. 2005; 37(4):425–435. [PubMed: 16480170]
- Najavits LM, Weiss RD, Shaw SR. The link between substance abuse and posttraumatic stress disorder in women. *The American Journal on Addictions*. 1997; 6(4):273–283. [PubMed: 9398925]
- Najavits LM, Weiss RD, Shaw SR, Muenz LR. “Seeking safety”: Outcome of a new cognitive-behavioral psychotherapy for women with posttraumatic stress disorder and substance dependence. *Journal of Traumatic Stress*. 1998; 11(3):437–456. [PubMed: 9690186]
- North CS, Smith EM. Posttraumatic stress disorder among homeless men and women. *Psychiatric Services*. 1992; 43:1010–1016.
- Opsal A, Kristensen Ø, Larsen TK, Syversen G, Rudshaug BEA, Gerdner A, Clausen T. Factors associated with involuntary admissions among patients with substance use disorders and comorbidity: a cross-sectional study. *BMC Health Services Research*. 2013; 13:57. [PubMed: 23399599]
- Plotzker RE, Metzger DS, Holmes WC. Childhood sexual and physical abuse histories, PTSD, depression, and HIV risk outcomes in women injection drug users: a potential mediating pathway. *The American Journal on Addictions*. 2007; 16:431–438. [PubMed: 18058406]
- Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*. 2008; 40:879–891. [PubMed: 18697684]
- Preacher KJ, Kelley K. Effect size measures for mediation models: quantitative strategies for communicating indirect effects. *Psychological Methods*. 2011; 16(2):93. [PubMed: 21500915]

- Preacher KJ, Rucker DD, Hayes AF. Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research*. 2007; 42:185–227.
- Regier DA, Narrow WE, Rae DS. The epidemiology of anxiety disorders: The epidemiologic catchment area (ECA) experience. *Journal of Psychiatric Research*. 1990; 24:3–14. [PubMed: 2280373]
- Rehm J, Gnam W, Popova S, Baliunas D, Brochu S, Fischer B, Taylor B. The costs of alcohol, illegal drugs, and tobacco in Canada, 2002. *Journal of Studies on Alcohol and Drugs*. 2007; 68:886. [PubMed: 17960307]
- Rehm J, Mathers C, Popova S, Thavorncharoensap M, Teerawattananon Y, Patra J. Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. *The Lancet*. 2009; 373:2223–2233.
- Reinert DF, Allen JP. The Alcohol Use Disorders Identification Test: An update of research findings. *Alcoholism: Clinical and Experimental Research*. 2007; 31:185–199.
- Ressler KJ, Mercer KB, Bradley B, Jovanovic T, Mahan A, Kerley K, May V. Post-traumatic stress disorder is associated with PACAP and the PAC1 receptor. *Nature*. 2011; 470:492–497. [PubMed: 21350482]
- Rubin A, Migneault JP, Marks L, Goldstein E, Ludena K, Friedman RH. Automated Telephone Screening for Problem Drinking. *Journal of Studies on Alcohol and Drugs*. 2006; 67:454–457.
- Saunders JB, Aasland OG, Babor TF, Grant M. Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. *Addiction*. 1993; 88:791–804. [PubMed: 8329970]
- Scher CD, Stein MB, Asmundson GJG, McCreary DR, Forder DR. The Childhood Trauma Questionnaire in a community sample: Psychometric properties and normative data. *Journal of Traumatic Stress*. 2001; 14:843–857. [PubMed: 11776429]
- Schwartz AC, Bradley RL, Sexton M, Sherry A, Ressler KJ. Posttraumatic stress disorder among African Americans in an inner city mental health clinic. *Psychiatric Services*. 2005; 56:212–215. [PubMed: 15703352]
- Scioli-Salter ER, Forman DE, Otis JD, Gregor K, Valovski I, Rasmusson AM. The Shared Neuroanatomy Neurobiology of Comorbid Chronic Pain & PTSD: Therapeutic Implications. *The Clinical Journal of Pain*. (in press).
- Skinner HA. The drug abuse screening test. *Addictive Behaviors*. 1982; 7:363–371. [PubMed: 7183189]
- Slade EP, Stuart EA, Salkever DS, Karakus M, Green KM, Ialongo N. Impacts of age of onset of substance use disorders on risk of adult incarceration among disadvantaged urban youth: A propensity score matching approach. *Drug and Alcohol Dependence*. 2008; 95:1–13. [PubMed: 18242006]
- Sonne SC, Back SE, Zuniga CD, Randall CL, Brady KT. Gender Differences in Individuals with Comorbid Alcohol Dependence and Post-traumatic Stress Disorder. *The American Journal on Addictions*. 2003; 12:412–423. [PubMed: 14660155]
- Stewart SH. Alcohol abuse in individuals exposed to trauma: a critical review. *Psychological Bulletin*. 1996; 120:83. [PubMed: 8711018]
- Swendsen J, Burstein M, Case B, Conway KP, Dierker L, He J, Merikangas KR. Use and abuse of alcohol and illicit drugs in US adolescents: Results of the National Comorbidity Survey-Adolescent Supplement. *Archives of General Psychiatry*. 2012; 69:390–398. [PubMed: 22474107]
- Swendsen J, Conway KP, Degenhardt L, Glantz M, Jin R, Merikangas KR, Kessler RC. Mental disorders as risk factors for substance use, abuse and dependence: results from the 10-year follow-up of the National Comorbidity Survey. *Addiction*. 2010; 105:1117–1128. [PubMed: 20331554]
- Taft CT, Pless AP, Stalans LJ, Koenen KC, King LA, King DW. Risk factors for partner violence among a national sample of combat veterans. *Journal of Consulting and Clinical Psychology*. 2005; 73:151. [PubMed: 15709842]
- Waldrop AE, Back SE, Verduin ML, Brady KT. Triggers for cocaine and alcohol use in the presence and absence of posttraumatic stress disorder. *Addictive Behaviors*. 2007; 32(3):634–639. [PubMed: 16863682]

- Walker EA, Gelfand A, Katon WJ, Koss MP, Von Korff M, Bernstein D, Russo J. Adult health status of women with histories of childhood abuse and neglect. *The American Journal of Medicine*. 1999; 107:332–339. [PubMed: 10527034]
- Wells K. Substance abuse and child maltreatment. *Pediatric Clinics of North America*. 2009; 56:345–362. [PubMed: 19358920]
- Wells K, Klap R, Koike A, Sherbourne C. Ethnic disparities in unmet need for alcoholism, drug abuse, and mental health care. *American Journal of Psychiatry*. 2001; 158:2027–2032. [PubMed: 11729020]
- Widom CS, Morris S. Accuracy of adult recollections of childhood victimization, part 2: Childhood sexual abuse. *Psychological assessment*. 1997; 9:34.
- Zhao X, Lynch JG, Chen Q. Reconsidering Baron and Kenny: Myths and truths about mediation analysis. *Journal of Consumer Research*. 2010; 37:197–206.

Figure 1.
Proposed Model for Moderated Mediation Analysis

Table 1
Self-reported Childhood Trauma, PTSD Symptoms, Problematic Alcohol Use, and Problematic Substance Use

	Men (<i>n</i> = 803)	Women (<i>n</i> = 2084)	Total (<i>n</i> = 2887)	1 – CTQ	2 – MPSS	3 – AUDIT	4 – DAST
1. CTQ Total	37.63 (13.99)	41.87 (19.03)	40.69 (17.87)	-			
2. MPSS Total	12.77 (12.27)	13.08 (12.33)	13.00 (12.32)	.47	-		
3. AUDIT Total	7.46 (8.11)	3.23 (5.43)	4.41 (6.57)	.16	.23	-	
4. DAST Total	1.61 (2.22)	.85 (1.70)	1.06 (1.89)	.18	.23	.40	-

Note: CTQ = Childhood Trauma Questionnaire, MPSS = Modified PTSD Symptom Scale, AUDIT = Alcohol Use Disorders Identification Test, and DAST = Drug Abuse Screening Test; CTQ, AUDIT, and DAST total scores vary significantly by gender at $p < .001$; all bivariate correlations are significant at $p < .001$

Table 2

Comorbidity Status by Gender

Comorbidity Status— <i>N</i> (%)	Male	Female
Neither PTSD nor Problematic Alcohol and/or Substance Use	323 (40.27%)	1195 (57.67%)
PTSD Alone	99 (12.34%)	457 (22.06%)
Problematic Alcohol and/or Substance Use Alone	229 (28.55%)	224 (10.81%)
Both PTSD and Problematic Alcohol and/or Substance Use	151 (18.83%)	196 (9.46%)

Note: All column proportions vary significantly by gender at $p < .05$.

Table 3

Results of the Moderated-Mediation Analysis for AUDIT

Path <i>a</i> , from CTQ (X) to MPSS (M)				
Predictor	<i>b</i>	<i>SE</i>	95% CI _{lower}	95% CI _{upper}
CTQ (X)	.384	.027	.330	.437
Gender (W)	1.399	1.239	−1.030	3.828
CTQ (X) × Gender (W)	−.065	.030	−.124	−.006
Path <i>b</i> , from MPSS (M) to AUDIT (Y)				
Predictor	<i>b</i>	<i>SE</i>	95% CI _{lower}	95% CI _{upper}
CTQ (X)	.038	.010	.024	.052
Gender (W)	−3.79	.365	−4.507	−3.075
MPSS (M)	.135	.018	.100	.170
MPSS (M) × Gender (W)	−.049	.021	−.089	−.008
Conditional Indirect Effect of PTSD (M) at Level of Gender (W)				
Moderator Level	<i>b</i>	<i>SE</i>	95% CI _{lower}	95% CI _{upper}
Men	.052	.010	.033	.073
Women	.028	.004	.020	.037

Note: AUDIT = Alcohol Use Disorders Identification Test, MPSS = Modified PTSD Symptom Scale, CTQ = Child Trauma Questionnaire; X = Independent Variable, Y = Dependent Variable, M = Mediating Variable, and W = Moderating Variable; *b* = unstandardized coefficient

Table 4

Results of the Moderated-Mediation Analysis for DAST

Path <i>b</i> , from MPSS (M) to DAST (Y)				
Predictor	<i>b</i>	<i>SE</i>	95% <i>CI</i> _{lower}	95% <i>CI</i> _{upper}
CTQ (X)	.013	.002	.009	.017
Gender (W)	−.663	.108	−.875	−.451
MPSS (M)	.036	.005	.025	.046
MPSS (M) × Gender (W)	−.012	.006	−.024	−.0002
Conditional Indirect Effect of PTSD (M) at Level of Gender (W)				
Moderator Level	<i>b</i>	<i>SE</i>	95% <i>CI</i> _{lower}	95% <i>CI</i> _{upper}
Men	.014	.003	.008	.020
Women	.007	.001	.005	.010

Note: DAST = Drug Abuse Screening Test, MPSS = Modified PTSD Symptom Scale, CTQ = Child Trauma Questionnaire; X = Independent Variable, Y = Dependent Variable, M = Mediating Variable, and W = Moderating Variable; *b* = unstandardized coefficient