



Dimensions of childhood trauma and their direct and indirect links to PTSD, impaired control over drinking, and alcohol-related-problems

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ABSTRACT

Introduction: Post-Traumatic Stress Disorder (PTSD) develops after experiencing events that evoke fear, helplessness, or horror. The Hyperarousability Hypothesis suggests that those with PTSD may drink more to dampen physiological reactivity. We examined the direct and indirect relationships between childhood trauma (e.g., physical-neglect, emotional-abuse, physical-abuse, sexual-abuse) versus an emotionally-supportive-family on PTSD, impaired control over drinking (IC), alcohol-use, and alcohol-related-problems. IC reflects consuming more alcohol than one originally intended.

Methods: We fit a multiple-group SEM to data on 835 participants. Mediation analyses were conducted by using the (K = 20,000) bootstrap technique with confidence intervals.

Results: Physical-neglect was directly linked to more IC among both genders. Emotional abuse was also found to be directly linked to more PTSD among both genders. Furthermore, PTSD was directly linked to more impaired control over alcohol use (IC) among both genders. Mediation analyses showed that physical-neglect was indirectly linked to more alcohol-related-problems through increased IC. Having an emotionally supportive family was directly linked to fewer PTSD symptoms among women. For both genders, emotional abuse was indirectly linked to more alcohol-related-problems through more PTSD symptoms, impaired control over alcohol use difficulties, and in turn, more alcohol-use. Sexual abuse was indirectly linked to increased alcohol-related-problems through increased PTSD symptoms and more IC, and in turn, more alcohol-use among men.

Conclusions: Recalled childhood trauma (sexual and emotional abuse) may contribute to PTSD symptoms and dysregulated drinking. In conclusion, our data suggest that reducing PTSD symptoms may assist individuals in regaining control over their drinking.

1. Introduction

1.1. Post-Traumatic Stress Disorder

Post-Traumatic Stress Disorder (PTSD) reflects intense disturbing thoughts and feelings as well as heightened arousal states triggered by associations with untoward events (APA, 2020). The Hyperarousability Hypothesis suggests that those with PTSD may drink more to dampen the physiological reactivity they experience when triggered (Livingston et al., 2020; Weston, 2014). According to Regulation Theory, individuals may actually be using alcohol to adjust their level of arousability (Tronnie, 2015). Other investigators following the Endorphin

Compensation Model (ECM; Volpicelli & Ulm, 1990) suggest that excessive alcohol use is an attempt to relieve an endorphin deficiency caused by the original traumatic event. Presumably after experiencing trauma, some individuals may experience distress (Contractor, Armour, Forbes, & Elhai, 2016; Marshall-Berenz, Vujanovic, & MacPherson, 2011; O'Hare & Sherrer, 2009) and some degree of physiological reactivity to cues associated with their trauma exposure (Van der Kolk, 1983). Unable to deal with this physiological reactivity, individuals may turn to excessive alcohol use to dampen the arousal reactivity.

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1.2. Causes and consequences of PTSD

Events known to cause PTSD typically involve experiencing some form of interpersonal violence (e.g., rape, assault, bullying etc.), exposure to life-threatening incidents (e.g., motor vehicle accident), or natural disasters (e.g., hurricane, earthquake, tornados, and wildfires; Yehuda, 2002). PTSD can develop after experiencing events that evoke fear, helplessness, or horror, even without the presence of danger (APA, DSM-V, 2013; Yehuda, 2002). Approximately, 7–8 individuals out of every 100, experience PTSD symptoms at some point in their lifetime (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995).

Not only is PTSD problematic due to its heightened arousal states and avoidance behaviors, but it is often comorbid with a wide variety of disorders. People with PTSD experience higher rates of depression (O'Donnell, Creamer, & Pattison, 2004), eating disorders (Brewerton, 2007), social phobias, generalized anxiety disorder (Hubbard, Realmuto, Northwood, & Masten, 1995), aggression (Sherman, Sautter, Jackson, Lyons, & Han, 2007), and suicidal ideation (Tarrier & Gregg, 2004) than those without PTSD. Individuals suffering from PTSD typically experience a number of neurological or biological changes such as reduced hippocampal volume (Rubin et al., 2016) and chronic insomnia or sleep disturbances (Riemann et al., 2010; Waldrop, Back, Sensenig, & Brady, 2008). Further, individuals with PTSD exhibit greater difficulties in regulating their emotions (Tull, Barrett, McMillan, & Roemer, 2007), which could presumably influence their alcohol consumption. Individuals with PTSD from a traumatic event are 2–4 times more likely to abuse alcohol (Jacobsen, Southwick, & Kosten, 2001; McCauley, Kill-een, Gros, Brady, & Back, 2012).

1.3. Childhood maltreatment

The experience of abuse(s) or significant forms of stress during childhood can greatly impact brain development as well as the acquisition of appropriate social skills (Kim & Cicchetti, 2006, 2010; Rasmussen et al., 2011). Approximately 702,000 children in the United States are victims of abuse and/or neglect each year (U.S. Department of Health & Human Services, 2016, 2018). Bernstein et al. (2003) have characterized childhood maltreatment as a multifaceted construct. Childhood maltreatment includes: (1) physical neglect (i.e. not being provided proper shelter, food, or medical care), (2) emotional abuse (i.e. being verbally attacked), (3) physical abuse (i.e. having one's body assaulted by another such as being hit or slapped), (4) sexual abuse (i.e. inappropriate touching or rape), and (5) a lack of support (i.e. parents and family not providing appropriate help or care at appropriate times). Immediate exposure to childhood maltreatment can result in lowered intellect, academic performance, attachment to others, and emotional maturity (Anyanwu & Campbell, 2001; Fishbein et al., 2009). Later on in life, those with a history of childhood maltreatment are at an increased risk for obesity, eating disorders, risky sex, sleep difficulties, revictimization, homelessness, mood disorders, PTSD, suicide attempts, and substance abuse (Kendall-Tackett, 2002).

1.4. Is PTSD a mediator of trauma and dysregulated drinking?

In a clinical trial for the treatment of alcohol use disorders (AUDs; $n = 1,726$), 77% of women and 54% of men claimed some form of early maltreatment/abuse that was either considered sexual, physical or neglectful (Rice et al., 2001). While a variety of mechanisms could potentially influence the relationship between childhood maltreatment and drinking outcomes, PTSD is one possible mediator (Lang et al., 2010; Kendall-Tackett, 2002). For instance, Watt et al. (2012) found that PTSD mediates the relationship between number of traumatic categories (i.e. emotional, physical, and sexual) experienced and hazardous drinking behavior based on an AUDIT score among women attending alcohol-serving venues in Capetown, South Africa. Nevertheless, our contribution to the PTSD mediation literature in this current study is

novel because we also included the categories of physical neglect and supportive family items. We also examined distinct facets of trauma as predictors rather than as a count of traumatic experiences. Further, our study is novel because we examined traumatic experiences among both men and women in a college student population.

1.5. Instances of trauma and PTSD in college populations

The extant literature has found that both college students and the general population experience similar rates of sexual, physical, and emotional abuse (Duncan, 2000; Kenny & McEachern, 2000). Moreover, previously traumatized students are at higher risk for experiencing another traumatic event while on campus (Fisher, Cullen, & Turner, 2000) and experienced greater mental health challenges as adults (Carr, Martins, Stingel, Lemgruber, & Juruena, 2013; Schwandt, Heilig, Hommer, George, & Ramchandani, 2013). Recently, Contractor et al. (2016) found that PTSD in college students was most strongly related to negative urgency. In addition, under-controlled heavy drinking (4+ or more drinks for women; 5+ or more drinks for men) is a major concern among college students and is an important public health concern (Wechsler, Lee, Kuo, & Lee, 2000; NIAAA, 2015a; U.S. Department of Health & Human Services, 2016, 2018). Furthermore, there are various negative consequences of alcohol use among college students including motor vehicle accidents, risky sex, sexual assault, physical assaults, injuries, and fatalities (Hingson, Heeren, Winter, & Wechsler, 2005). Recently there is an increased interest in the study of trauma and drinking patterns among college students. For instance, Frohe, Leeman, Cheong, Belton, and Patock-Peckham (2020) found that a composite mindfulness measure mediated the indirect link between physical and emotion forms of childhood neglect on impaired-control-over-drinking (IC).

1.6. Behavioral economics, impulsivity, and impaired control over alcohol use (IC)

The Theory of Behavioral Economics suggests that individuals are more likely to take an immediately presented reinforcer (i.e. another alcoholic beverage right now) rather than a delayed reinforcer (i.e. the ability to wake up on time for work the next day hangover free). This is due to alcohol's higher perceived immediate value and the uncertainty regarding when this reinforcing substance will be available again (Vuchinich & Heather, 2003). According to Casada and Roache's (2005) disinhibition view of impulsivity, individuals may struggle to inhibit behaviors particularly when they perceive those behaviors to be rewarding and stress reducing with little to no concern for the consequences of their actions. Both the Theory of Behavioral Economics and a disinhibition view of impulsivity provide possible explanations for the development of impaired-control-over-alcohol-use among those who were physically neglected (see Frohe et al., 2020). Impaired control over drinking (IC) is the inability to stop drinking after one has begun consuming alcohol, despite self-imposed limitations on alcohol consumption (Heather, Tebbutt, Mattick, & Zamir, 1993). Prospectively IC is one of the earliest symptoms of alcohol use disorder (AUD) to manifest (Leeman, Toll, Taylor, & Volpicelli, 2009). Reviews on IC (Leeman, Patock-Peckham, & Potenza, 2012; Leeman et al., 2014) reveal that some investigators have described IC as impulsivity specific to the drinking context (Patock-Peckham, Cheong, Balhorn, & Nagoshi, 2001; Patock-Peckham and Morgan-Lopez, 2006; Patock-Peckham et al., 2011). While others suggest that while IC reflects an adherence to an intent to limit drinking, with impulsivity there may never be an intention to limit drinking (Bickel & Marsch, 2001). IC's relationship to impulsivity is important because there appears to be a genetic liability regarding impulsivity and alcohol and substance use (Edwards & Kendler, 2012; Verdejo-García, Lawrence, & Clark, 2008). In addition, family history positive college students for alcoholism showed higher levels of self-reported IC (Leeman, Fenton, & Volpicelli, 2007).

Furthermore, self-reported IC has been found to be associated with brain structures such as the insula, precentral gyrus, and putamen (Claus et al., 2011) as well as dopaminergic activity (Modell et al., 1993). This is important because dopaminergic activity has also been linked to choice impulsivity (Arnsten, 2007; Jentsch & Taylor, 1999; Volkow, Fowler, & Wange, 2002). However, to date no one has explored the direct and indirect relationships between trauma, PTSD, and IC. Studying the links between trauma, PTSD and IC is important because, childhood maltreatment and PTSD can lead to impulsive tendencies later in life (Wardell, Strang, & Hendershot, 2016) such as suicide (Weiss, Tull, Anestis, & Gratz, 2013). From this connection, as well as how IC has been described by some investigators (Patock-Peckham et al., 2001, 2006, 2011), a direct link between childhood maltreatment and increased IC seems plausible. Yet, it is not entirely clear how trauma and PTSD may lead to impulsivity specific to the drinking context (i.e. IC) as this will be the first study to explore these variables all together.

As most drinking consequences occur following excessive alcohol consumption, direct and indirect links between childhood trauma, PTSD, and IC are important to investigate. Based upon Behavioral Economic Theory (Vuchinich & Heather, 2003) and recent findings from Frohe et al. (2020) we hypothesized that physical neglect would be directly linked to increased IC and, in turn, be associated indirectly with more alcohol-use and alcohol-related-problems. We expected this because physically neglected individuals are often deprived of reinforcing substances (e.g., food, shelter, water, and clothing), and therefore would presumably be more likely to use alcohol to excess when available (Vuchinich & Heather, 2003). We did not have a clear prediction regarding physical neglect and PTSD but tested the path for thoroughness.

In sum, we were interested in examining the extent to which different types of childhood trauma at the hands of a caregiver or parent (i.e., physical neglect, emotional abuse, physical abuse, and sexual abuse) would contribute to increased PTSD symptoms and, in turn, be associated with both more IC, alcohol-use and alcohol-related-problems. Furthermore, we sought to determine if experiencing an emotionally supportive family environment would be shielding against the development of PTSD and, in turn, be associated with both less IC, alcohol-use and alcohol-related-problems. Another main goal of the present study was to contribute to the PTSD literature by examining whether PTSD would be directly linked to IC along the alcohol-related problems pathway. Based upon a number of different theories (i.e. Hyper-arousal, Regulation, ECM) we hypothesized that childhood maltreatment (i.e., emotional abuse, physical abuse, sexual abuse) will be directly linked to PTSD, which will in turn, be linked to more IC, and in turn, more alcohol-use and alcohol-related problems.

Compared to boys, girls are more likely to experience childhood sexual abuse, but are less likely to experience physical abuse and neglect (Tolin & Foa, 2006, 2008). Nevertheless, full-grown women are more likely to experience more types of physical abuse, such as domestic violence later on in life than are men (Kessler, Molnar, Feurer, & Appelbaum, 2001; Jones, Hughes, & Unterstaller, 2001). In our sample, we expected that women would be more likely to experience emotional and sexual abuse, but that men would be more likely to experience physical abuse or neglect before the age of 12. Thus, we included gender as a potential moderator of the relationships among the variables in our model.

2. Methods

2.1. Sample

Participants included 835 university students (368 women, 467 men) from the United States of America. All participants gave their informed consent and earned PSY101 course credit for their participation. We excluded participants who were not at least 18 years of age or who were not proficient in English. The university Institutional Review

Board approved our protocol. The sample was 56% male, with an average age of 20.41 years (SD = 3.27). The sample was 66% Caucasian, 14% Hispanic, 10% Asian, and 4% African American, and 6% reported "other" race/ethnicity.

2.2. Measures

2.2.1. Childhood Trauma Questionnaire (CTQ)

The Childhood Trauma Questionnaire (Bernstein et al., 2003) consists of 25-items measuring physical-neglect, emotional-abuse, physical-abuse, sexual-abuse, and emotional-neglect retrospectively from childhood. In the present study, physical abuse, emotional abuse, sexual abuse, and physical neglect were worded to reflect mistreatment, whereas support was worded to reflect care. Therefore, we opted to use the phrase "emotionally supportive family" to be consistent with the original valence and the question structure. Physical-neglect consists of 5-items including, "I didn't have enough to eat." For this sample, 38.52% reported experiencing some level of physical neglect. Emotional-abuse consists of 5-items including, "People in my family said hurtful or insulting things to me." For this sample, 37.55% reported slight, moderate, severe, or extreme emotional abuse. Physical-abuse consists of 5-items including, "People in my family hit me so hard it left me with bruises or marks." For this sample, 32.80% reported experiencing slight, moderate, severe or extreme physical abuse. Sexual-abuse consists of 5-items including, "Someone tried to touch me in a sexual way or tried to make me touch them." For this sample, 26.20% reported being sexually abused. An emotionally supportive family, consists of 5-items including, "People in my family felt close to each other", "Felt loved", "Was looked out for", "Made me feel important", and "Family was a source of strength". For this sample, 60.09% felt extremely well cared for by their parents. Responses were measured on a 1–5 Likert scale with, 1 = 'never true' and 5 = very often true). The α reliabilities for this sample were physical-neglect (0.71), emotional-abuse (0.84), physical-abuse (0.84), sexual-abuse (0.91), and emotionally supportive family (0.91).

2.2.2. Post-Traumatic Stress Disorder (PTSD)

The PTSD Checklist: Civilian Version (PCL-C; Weathers, Huska, & Keane, 1991; Weathers, Litz, Huska, & Keane, 1994) consists of 17-items and measures the presence of PTSD symptoms in individuals who experienced traumatic events that are unrelated to military service or combat action. Items inquired about typical symptoms related to PTSD such as dreams, thoughts, emotions, sleep, and isolation. Each of the 17-items was measured on a 1–5 Likert scale, with 1 = 'not at all' and 5 = 'extremely.' In this sample, 46.5% reported at least some PTSD symptoms. The α reliability for this sample was (0.96).

2.2.3. Impaired Control Over Drinking (IC)

This scale reflects 10-items from Part III of the Impaired Control Scale (ICS; Heather et al., 1993). Higher scores on this measure reflect a lack of perceived control over drinking (i.e., an inability to stop drinking at will). A sample item included, "Even if I intended having only one or two drinks, I would end up having many more." Responses for the ICS were measured on a 1–5 Likert scale, with 1 = 'strongly disagree' and 5 = 'strongly agree'. The α reliability for this sample was (0.84).

2.2.4. Alcohol Use (quantity/frequency)

We measured drinking quantity using a single item (Wood, Nagoshi, & Dennis, 1992), which asked, "What is your usual quantity of alcoholic beverages consumed at one drinking occasion?" The responses included: 1 = one bottle or can of beer, one glass of wine, or one drink of distilled spirits, 2 = two bottles, glasses, or drinks, 3 = three or four bottles, glasses, or drinks, 4 = five or six bottles, glasses, or drinks, 5 = seven or more bottles, glasses, or drinks. We measured drinking frequency using a single item (Wood et al., 1992), which asked, "How often did you consume alcoholic beverages in the past year?" The responses included:

1 = less than once a month, 2 = once a month, 3 = two or three times a month, 4 = once a week, 5 = two or three times a week, 6 = four or five times a week, and 7 = daily or nearly daily. Quantity and frequency items were combined to a single measure; the values for quantity and frequency were multiplied and then the distribution of scores were transformed through a log₁₀ transformation (Wood et al., 1992).

2.2.5. Alcohol-Related Problems

The Young Adult Alcohol Problems Screening Test (YAAPST; Hurlbut & Sher, 1992) contains 27-items and assessed the frequency of common drinking consequences experienced by young adults. Sample items included, “Have you ever driven a car when you knew you had too much to drink to drive safely?” and “Have you ever gotten into physical fights when drinking?” Response options reflected the frequency of experiencing each consequence. For scoring, see Hurlbut and Sher (1992). For this sample, 70.4% experienced at least 4 consequences in their lifetime (see NIH/NIAAA report-Brief Interventions in College Settings, Larimer, Crounce, Lee, & Kilmer, 2020). The α reliability for this sample was (0.87).

2.3. Statistical approach

Descriptive statistics were obtained using SPSS version 25.0, and the multiple-group analyses were conducted within a structural equation modeling framework in Mplus 7.4 (Muthén & Muthén, 1998–2020). Our multiple-group structural equation model was fit with full information maximum likelihood (FIML) estimation of missing data to evaluate our conceptual model (Fig. 1). To formally test for gender differences, we conducted an overall structural invariance test by simultaneously constraining all path coefficients to be equal across gender groups. Because the change in chi-square statistic exceeded the critical value ($p < .001$), we conducted subsequent path analyses separately by men and by women and conducted single df invariance tests for each path in the model to determine if pathway strength was the same or different among the two genders. Next, we examined two-and three-path mediational effects. Our model fit was evaluated with chi-square statistics, RMSEA (Browne & Cudeck, 1993; Hu & Bentler, 1998) and CFI (Bentler, 1990). Indirect effects were tested by examining whether the parametric bootstrapped ($K = 20,000$) 95% confidence interval around the estimates of the indirect effects included zero or not (MacKinnon, 2008; MacKinnon, Lockwood, & Williams, 2004; Taylor, MacKinnon & Tein, 2008); indirect effects do not include zero.

3. Results

Table 1 shows the means, standard deviations, and correlations among all variables in the model. All hypothesized paths were modeled (Fig. 1; the conceptual model), as were all significant paths for women (Fig. 2) and men (Fig. 3). The model yielded a χ^2 (10df) = 11.508, $p = 0.3193$, CFI = 0.998, RMSEA = 0.019, 90% [0.000, 0.058]. The overall invariance test with all paths constrained to be equal across gender yielded χ^2 (31df) = 72.442, $p < .001$, CFI = 0.955, RMSEA = 0.057, 90% [0.040, 0.074]. As the the $\Delta \chi^2$ difference test with (21df) = 60.934, $p < .001$, we thus presented our models separately by gender. Individualized invariance tests for each path are on Table 4 Presented in Figs. 2 and 3 are the standardized beta coefficients for each significant path.

3.1. Direct effects (unstandardized coefficients) among women

We hypothesized that there would be a **direct link between PTSD and IC**. We found that higher levels of PTSD symptoms were directly related to more IC among women ($\beta = 0.010$, S.E. = 0.003, $Z = 3.013$, $p = .003$). Additionally, higher levels of IC were directly related to more alcohol-use ($\beta = 0.378$, S.E. = 0.053, $Z = 7.205$, $p < .001$) and more alcohol-related-problems among women ($\beta = 0.122$, S.E. = 0.042, $Z = 2.929$, $p = .003$). Moreover, higher levels of PTSD symptoms ($\beta = 0.008$, S.E. = 0.002, $Z = 3.750$, $p < .001$) and higher levels of alcohol-use ($\beta = 0.398$, S.E. = 0.037, $Z = 10.723$, $p < .001$) were directly linked to more alcohol-related-problems among women.

As you may recall we hypothesized that **physical neglect would be directly linked to increased IC**. Higher levels of physical-neglect were directly linked to more IC ($\beta = 0.239$, S.E. = 0.088, $Z = 2.712$, $p = .007$), yet were directly linked to less alcohol use among women ($\beta = -0.192$, S.E. = 0.073, $Z = -2.614$, $p = .009$).

We also hypothesized that **childhood maltreatment facets** would be directly linked to **increased PTSD symptoms**, while an **emotionally supportive family** would be **shielding against PTSD symptoms**. We found that higher levels of emotional-abuse were directly related to more PTSD symptoms among women ($\beta = 5.782$, S.E. = 1.370, $Z = 4.221$, $p < .001$). Conversely, higher levels of emotional support from one’s family were directly linked to less PTSD among women ($\beta = -2.641$, S.E. = 1.100, $Z = -2.332$, $p = .020$). Nevertheless, higher levels of emotional support from one’s family were directly linked to more alcohol-related-problems ($\beta = 0.078$, S.E. = 0.034, $Z = 2.266$, $p = .023$). Table 2 contains the mediated effects at the 95% confidence interval among women.

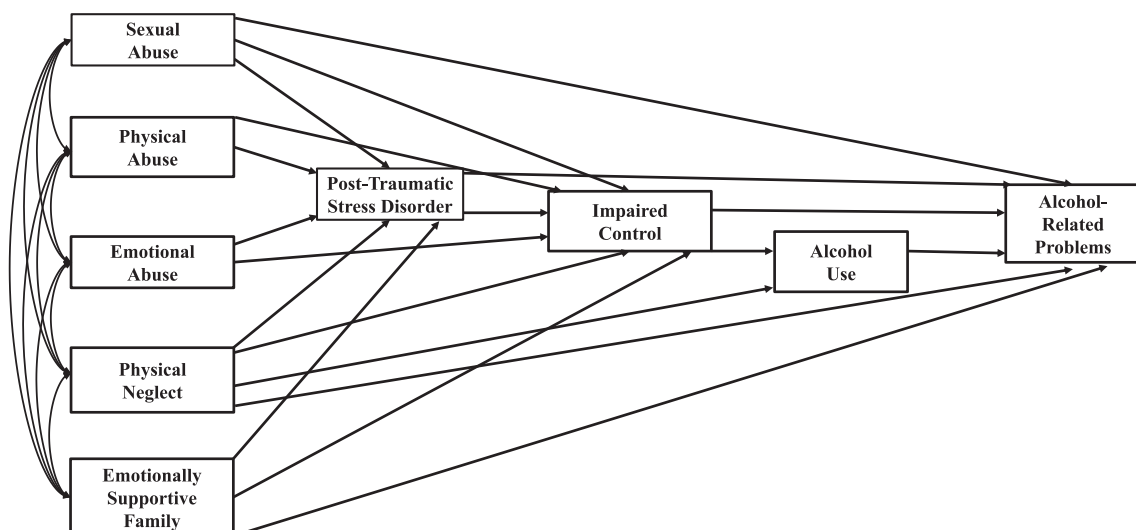


Fig. 1. Conceptual model of all examined paths among the exogenous and endogenous variables in the model.

Table 1
Means, standard deviations, and correlations among all variables in the path model.

M	SD	Measures	1	2	3	4	5	6	7	8	9
1.31	0.79	1. Sexual Abuse	1.00	0.39	0.35	0.28	-0.23	0.26	0.08	-0.05	-0.03
1.41	0.80	2. Physical Abuse	0.60	1.00	0.63	0.41	-0.43	0.39	0.09	-0.09	0.03
1.60	0.80	3. Emotional Abuse	0.59	0.77	1.00	0.39	-0.59	0.51	0.11	0.04	0.12
1.72	0.86	4. Physical Neglect	0.60	0.58	0.58	1.00	-0.62	0.28	0.23	-0.06	0.03
1.68	0.78	5. Emotionally Supportive Family	-0.31	-0.31	-0.43	-0.63	1.00	-0.41	-0.18	-0.01	-0.04
1.40	0.59	6. Post-Traumatic Stress Disorder	0.47	0.48	0.54	0.40	-0.29	1.00	0.23	0.11	0.29
1.65	0.73	7. Impaired Control	0.42	0.32	0.30	0.44	-0.28	0.36	1.00	0.38	0.40
1.78	0.71	8. Alcohol Use	-0.08	-0.07	-0.06	-0.12	0.07	-0.05	0.22	1.00	0.59
1.83	0.71	9. Alcohol-Related Problems	0.34	0.28	0.26	0.29	-0.16	0.32	0.48	0.44	1.00
3.78	0.96										
3.66	0.99										
32.96	15.08										
31.65	13.83										

Means, standard deviations, and correlations among all variables based on a sample of 835 individuals (467 men = bottom in *italics*, 368 women = top in **bold**).

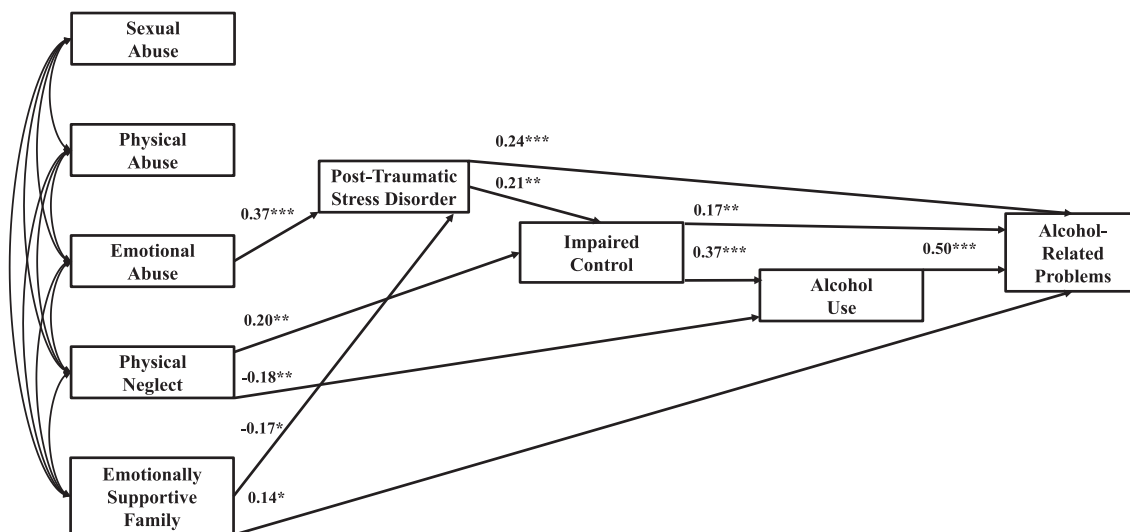


Fig. 2. Fit path model for women. Standardized coefficients are shown for women with all exogenous variables allowed to correlate freely in the model. * $p < 0.05$, $p < 0.01$, * $p < 0.001$.

3.2. Direct effects (unstandardized coefficients) among men

We hypothesized that there would be a **direct link between PTSD and IC**. We found that PTSD was directly linked to more IC among men ($\beta = 0.010$, S.E. = 0.003, $Z = 3.463$, $p = .001$). Moreover, higher levels of IC were directly linked to more alcohol-use ($\beta = 0.323$, S.E. = 0.049, $Z = 6.603$, $p < .001$) and more alcohol-related-problems among men ($\beta = 0.219$, S.E. = 0.057, $Z = 3.842$, $p < .001$). Further, higher levels of PTSD symptoms ($\beta = 0.008$, S.E. = 0.003, $Z = 2.871$, $p = .004$) and higher levels of alcohol-use ($\beta = 0.456$, S.E. = 0.048, $Z = 9.468$, $p < .001$) were directly linked to more alcohol-related-problems among men.

As you may also recall we hypothesized that **physical neglect would be directly linked to increased IC**. Higher levels of physical-neglect were directly linked to more IC among men ($\beta = 0.271$, S.E. = 0.069, $Z = 3.922$, $p < .001$), yet were directly related to less alcohol-use among men ($\beta = -0.223$, S.E. = 0.056, $Z = -3.995$, $p < .001$). In addition, higher levels of sexual-abuse were directly linked to more IC among men ($\beta = 0.199$, S.E. = 0.057, $Z = 3.472$, $p = .001$). Further, higher levels of sexual-abuse were directly related to more alcohol-related-problems among men ($\beta = 0.132$, S.E. = 0.051, $Z = 2.604$, $p = .008$).

We also hypothesized that **childhood maltreatment facets** would be directly linked to **increased PTSD symptoms**, while an **emotionally supportive family** would be **shielding against PTSD symptoms**. We found that higher levels of emotional-abuse ($\beta = 5.764$, S.E. = 1.445, $Z = 3.989$, $p < .001$) and sexual-abuse ($\beta = 3.618$, S.E. = 1.082, $Z = 3.344$, $p = .001$) were directly linked to more PTSD symptoms among men. Table 3 contains the mediated effects at the 95% confidence interval among men.

4. Discussion

4.1. PTSD and impaired control over alcohol use (IC)

While this study is not a clear test of the multitude of theories surrounding the clear connection between PTSD symptoms and AUDs (e.g. Hyperarousability Hypothesis, Livingston et al., 2020; Weston, 2014; Regulation Theory, Tronnier, 2015; ECM, Volpicelli & Ulm, 1990; Self-Medication, Conger, 1956; Hersh & Hussong, 2009) it does add to our etiological understanding of some of the mechanisms involved. In particular, we add to the existing literature by illustrating a clear direct link between PTSD and impaired control over alcohol use (IC; Heather

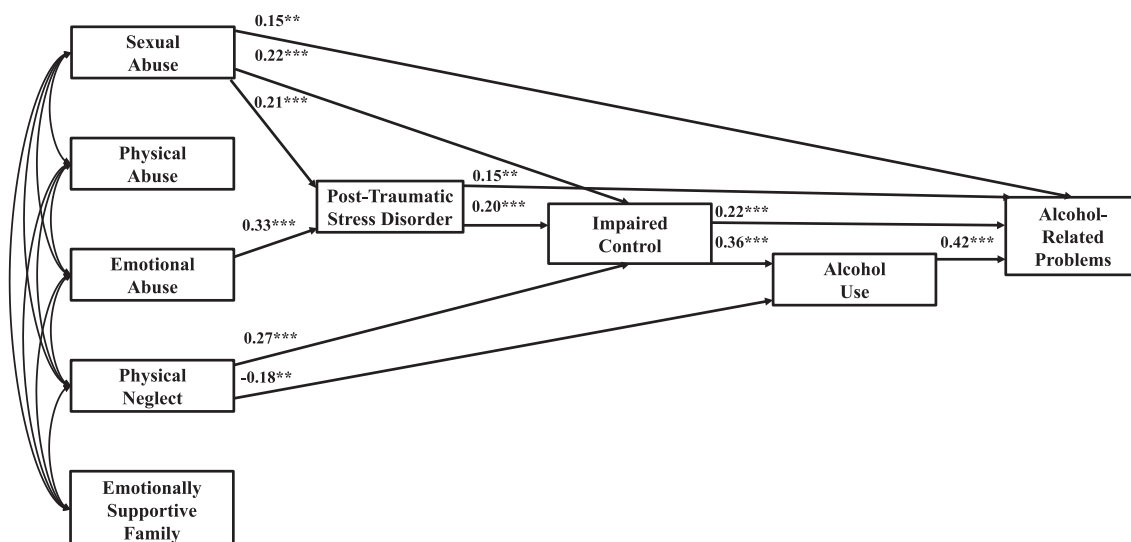


Fig. 3. Fit path model for men. Standardized coefficients are shown for men with all exogenous variables allowed to correlate freely in the model. * $p < 0.05$, $p < 0.01$, * $p < 0.001$.

Table 2 Mediated pathways.

Pathway Effects	Indirect Effect	Z-Score	P-Value	95% CI
Indirect Effects for Women				
Impaired Control (IC)				
Emotional Abuse → PTSD → IC	0.057	2.295	0.022	(0.019, 0.119)
Supportive Family → PTSD → IC	-0.026	-1.763	0.078	(-0.067, -0.005)
Alcohol Use				
PTSD → IC → Alcohol Use	0.004	2.781	0.005	(0.001, 0.007)
Physical Neglect → IC → Alcohol Use	0.090	2.660	0.008	(0.028, 0.163)
Emotional Abuse → PTSD → IC → Alcohol Use	0.022	2.192	0.028	(0.007, 0.047)
Alcohol-Related Problems (ARP)				
PTSD → IC → ARP	0.001	1.877	0.061	(0.000, 0.003)
PTSD → IC → Alcohol Use → ARP	0.002	2.697	0.007	(0.001, 0.003)
Supportive Family → PTSD → ARP	-0.022	-1.881	0.060	(-0.052, -0.005)
Supportive Family → PTSD → IC → Alcohol Use → ARP	-0.004	-1.656	0.098	(-0.011, -0.001)
Emotional Abuse → PTSD → ARP	0.048	2.629	0.009	(0.020, 0.093)
Emotional Abuse → PTSD → IC → Alcohol Use → ARP	0.009	2.133	0.033	(0.003, 0.019)
Physical Neglect → IC → ARP	0.029	1.848	0.065	(0.006, 0.071)

Note – PTSD = Post-Traumatic Stress Disorder; IC = Impaired Control; ARP = Alcohol-Related Problems.

et al., 1993). We uniquely show that impaired control is a mediating mechanism of the PTSD to alcohol-use and alcohol-related problems pathways. This is a new finding especially among a college student population.

4.2. Behavioral economics views of childhood maltreatment and impulsivity

Our findings here add to those of Wardell et al. (2016) who found that impulsivity, in the form of negative urgency, mediates the

Table 3 Mediated pathways.

Pathway Effects	Indirect Effect	Z-Score	P-Value	95% CI
Indirect Effects for Men				
Impaired Control (IC)				
Sexual Abuse → PTSD → IC	0.038	2.311	0.021	(0.012, 0.078)
Emotional Abuse → PTSD → IC	0.060	2.585	0.010	(0.024, 0.117)
Alcohol Use				
PTSD → IC → Alcohol Use	0.003	3.073	0.002	(0.002, 0.006)
Physical Neglect → IC → Alcohol Use	0.087	3.199	0.001	(0.042, 0.152)
Emotional Abuse → PTSD → IC → Alcohol Use	0.020	2.347	0.019	(0.008, 0.041)
Sexual Abuse → IC → Alcohol Use	0.064	3.062	0.002	(0.030, 0.114)
Sexual Abuse → PTSD → IC → Alcohol Use	0.012	2.252	0.024	(0.004, 0.026)
Alcohol-Related Problems (ARP)				
PTSD → IC → ARP	0.002	2.481	0.013	(0.001, 0.005)
PTSD → IC → Alcohol Use → ARP	0.002	3.085	0.002	(0.001, 0.003)
Sexual Abuse → PTSD → ARP	0.027	2.015	0.044	(0.008, 0.064)
Sexual Abuse → IC → ARP	0.044	2.594	0.009	(0.017, 0.084)
Sexual Abuse → PTSD → IC → ARP	0.008	1.930	0.054	(0.003, 0.020)
Sexual Abuse → PTSD → IC → Alcohol Use → ARP	0.006	2.265	0.023	(0.002, 0.012)
Emotional Abuse → PTSD → ARP	0.044	2.355	0.019	(0.015, 0.091)
Emotional Abuse → PTSD → IC → ARP	0.013	2.120	0.034	(0.005, 0.030)
Emotional Abuse → PTSD → IC → Alcohol Use → ARP	0.009	2.318	0.020	(0.003, 0.019)
Physical Neglect → IC → ARP	0.059	2.852	0.004	(0.025, 0.108)

Note – PTSD = Post-Traumatic Stress Disorder; IC = Impaired Control; ARP = Alcohol-Related Problems.

Table 4
Invariance Table: Gender Differences on path coefficients.

Model	χ^2	$\Delta\chi^2$
Base model (df10)	11.508	
Childhood Trauma to PTSD		
Physical Abuse	11.508	<1.000
Sexual Abuse	13.791	2.283
Emotional Abuse	11.508	<1.000
Physical Neglect	11.513	<1.000
Emotionally Supportive Family	13.495	1.987
Childhood Trauma to Impaired Control		
Physical Abuse	11.885	<1.000
Sexual Abuse	18.447	6.939**
Emotional Abuse	12.023	<1.000
Physical Neglect	11.602	<1.000
Emotionally Supportive Family	11.518	<1.000
PTSD to Impaired Control		
Physical Neglect to Alcohol Use	11.663	<1.000
PTSD to Alcohol Use	14.746	3.238
Impaired Control to Alcohol Use	12.141	<1.000
Childhood Trauma to Alcohol-Related Problems		
Sexual Abuse	23.261	11.753***
Emotional Abuse	11.898	<1.000
Physical Neglect	12.194	<1.000
Emotionally Supportive Family	12.888	1.380
PTSD to Alcohol-Related Problems		
Impaired Control to Alcohol-Related Problems	14.402	2.894
Alcohol Use to Alcohol-Related Problems	12.510	1.002

Note- We examined structural invariance among the genders by looking at each path in the model. The pathway from sexual abuse to impaired control is stronger for men than for women, $p < .01^{**}$. In addition, the pathway from sexual abuse to alcohol-related problems is stronger for men than for women, $p < .001^{***}$.

relationship between childhood maltreatment and alcohol-related problems. Other investigators have reported a link from PTSD to impulsivity (Roley, Contractor, Weiss, Armour, & Elhai, 2017; Weiss et al., 2013); however, the present study is the first to focus on the direct relationship between PTSD and IC. It is still rather unclear as to whether impulsivity and impaired control are distinct constructs (Leeman et al., 2012, 2014) or are different versions of each other in a specific context (Patock-Peckham et al., 2001, 2006, 2011). We characterized impaired control as a manifestation of impulsivity specific to the drinking context (Patock-Peckham et al., 2001, 2006, 2011). However, we also agree with Bickel & Marsch (2001) who suggest that the distinction between generalized impulsivity and impaired control may be that with the construct of impaired control there is some intention to limit drinking while with the construct of impulsivity there may never be an intention to limit drinking. Nevertheless, this is the first study to examine the indirect impact of childhood trauma to impaired control through the mediator of PTSD.

It is interesting to speculate that IC may be a manifestation of a more general impulsivity problem. Experimentally, impulsivity is generally measured using delay discounting paradigms from Behavioral Economics (e.g., would you rather have \$5 today or \$7 in one week?). It is clear that an inability to delay gratification may directly apply to AUDs (e.g., would you rather have one more drink now or have an easier time waking up for work in the morning?). Economic measures of delay discounting predict alcoholism (Petry, 2001), including severity (MacKillop et al., 2011) and likelihood of recovery (MacKillop & Kahler, 2009). Physically neglected individuals are often deprived of reinforcing substances (e.g., food, shelter, water, and clothing), and may therefore be more likely to use alcohol to excess when available. Similar effects may be evident due to other forms of abuse. Previous research has linked childhood maltreatment with impulsivity (Braquehais, Oquendo, Baca-García, & Sher, 2010), but only physical and sexual-abuse are typically examined. Other than Frohe et al. (2020), physical-neglect has rarely

been examined in studies of maltreatment; physically neglected children are raised in environments lacking basic needs. Based on the Theory of Behavioral Economics (Vuchinich & Heather, 2003), these children might take an immediately available reinforcer (e.g., food, water, alcohol) because there is uncertainty regarding when it may be presented again. Furthermore, this discounting process could continue into adolescence and young adulthood (i.e., when alcohol consumption typically begins) and may result in the development of impaired control and future alcohol-related problems. It is an intriguing possibility that childhood trauma, promulgated by PTSD, may disrupt normative subjective valuation processes to produce “reinforcer pathology” that includes impulsivity and IC (Bickel, Jarmolowicz, Mueller, & Gatchalian, 2011). Our results here also replicate (Frohe et al., 2020) as we also found a direct link between physical-neglect and impaired-control. This finding is highly consistent with Behavioral Economic ideas concerning AUDs (Vuchinich & Heather, 2003).

4.3. The role of emotional and physical abuse in the PTSD pathway to AUDs

One novel contribution to the existing literature was that higher levels of childhood emotional abuses were directly linked to more PTSD. Higher levels of emotional abuse were also indirectly linked to more impaired-control-over-drinking and, in turn, more alcohol-use and alcohol-related-problems. While prior studies have connected childhood emotional-abuse to PTSD (Spertus, Yehuda, Wong, Halligan, & Seremetis, 2003), this study is one of the first to shed light on several mechanisms that might lead to the development of alcohol-related-problems such as impaired control over alcohol use. Our findings are important because this is the first study to examine emotional-abuse as well as other forms of abuse (e.g. neglect, physical, sexual) simultaneously on multiple alcohol-related-outcomes all within the same model. In this study, we illustrated the indirect links between childhood trauma and drinking outcomes through both PTSD and IC.

Physical-abuse in childhood is a known precursor to a significantly higher risk of meeting all DSM-III-R criteria for major depression, PTSD, and antisocial behavior by age 21 (Silverman, Reinherz, & Giaconia, 1996) all of which are highly comorbid with AUDs. Importantly, our model included multiple types of childhood trauma to serve as predictors in a single statistical model, permitting us to make comparisons of the differential impact of each form of trauma over and above each other form of trauma. Emotional-abuse had a stronger link to PTSD, IC, alcohol-use, and alcohol-related-problems than physical-abuse; this suggests that emotional-abuse may be an important target for therapeutic intervention for college student populations, even among those who experienced physical-abuse. The stronger link of emotional-abuse to PTSD, IC, alcohol-use, and alcohol-related-problems presumably occurs because it would be rare that an individual would experience physical-abuse without the co-occurrence of emotional-abuse as well. Conceivably, the impact of emotional-abuse may linger longer than the effects of physical-abuse. However, replicating our findings both over-time as well as with a more clinical sample of participants would allow for stronger conclusions about this phenomenon to be drawn. Thus, these findings are exploratory in nature.

4.4. Sexual abuse, PTSD and men in a college sample

In the current study, sexual-abuse during childhood was directly linked to PTSD, consistent with the prior literature (Paolucci, Genuis, & Violato, 2001; Saywitz, Mannarino, Berliner, & Cohen, 2000). With all of the other types of abuses in the model, the link between sexual-abuse during childhood and PTSD was only a significant relationship among men. Presumably, sexually abused women likely experienced emotional-abuse at the same time. Consistent with the extant literature (Kendall-Tackett, 2002; Dube et al., 2005), sexual-abuse was found to be directly linked to alcohol-related-problems among men. Our study is novel; we

found that sexual-abuses were indirectly linked to impaired control through the mediating mechanism of PTSD for men. This is a new finding and provides researchers and therapists with new mechanisms (i.e. PTSD and IC) to influence the development of alcohol-related-problems in people who were sexually abused as children. While the relationship between sexual-abuse and impulsivity has been studied (Brotsky et al., 2001), our research is the first to show a link between childhood sexual-abuse and impaired control, which is more specific to the drinking context among men. This is the first study to test whether or not PTSD is a mediating mechanism in the impaired control to alcohol-related-problems pathway. The current study illustrates this pathway for both men and women.

4.5. Emotionally supportive families buffer PTSD symptoms among women

The current study also illustrates how a supportive family protects women against the development of PTSD along the impaired control to alcohol-related problems pathway. Having an emotionally supportive family was directly linked to less PTSD symptoms and was indirectly linked to less impaired control and alcohol-related-problems. Our findings here are consistent with previous work (Mallers, Charles, Neupert, & Almeida, 2010) that reported high quality relationships between children and parents were linked to improved mental health and less psychopathology.

4.6. Limitations and future directions

Although this study identifies several impactful findings regarding recalled childhood maltreatment and its relation to alcohol-related problems in college, there are several limitations to consider. The first limitation pertains to the cross-sectional nature of the study. A longitudinal study could better illustrate the temporal precedence of these relationships. We recognize that individuals who are heavy drinkers are more vulnerable to trauma and that our model does not test for this direction of potential relationships. Thus, our findings are a first exploratory pass at these patterns of relationships from one direction only. Another limitation is that our sample was composed entirely of college students. Therefore, it is not plausible to generalize our results to young adults within the sample age range without a college education, or to adults who have served in the military. Additionally, our study did not look at family history of alcoholism. Presumably, a chaotic family environment, such as those found with alcoholic parents, opens the door for more severe offspring abuse. In addition, this study did not include Gerdner and Allgulander's (2009) three childhood maltreatment items regarding minimalization and denial of the traumas. Furthermore, this study is limited, for although it is consistent with what would be expected by the plethora of theories explaining the relationship between PTSD and drinking behaviors this data does little to tease apart these theories. For instance, we failed to include a measure of drinking to cope and therefore cannot distinguish between Self-Medication and Hyperarousability theories of addiction here. Nevertheless, setting up competing theory test regarding theories surrounding PTSD and AUDs seems like a promising line of future research. It also seems prudent to include a number of physiological measures when possible to tease apart the large number of theories trying to explain the link between PTSD and AUDs.

4.7. Conclusions

Overall, the current study provides support for distal associations of childhood maltreatment with the development of alcohol-related-problems through PTSD and dysregulated drinking (i.e., IC). Our findings suggest that childhood physical-neglect may increase the likelihood of impaired control, which may contribute to the development of problematic drinking behaviors and negative outcomes. This is

consistent with Behavioral Economics Theories, including the reinforcer pathology for understanding substance misuse (Bickel et al., 2011; Vuchinich & Heather, 2003). Furthermore, those physically neglected during childhood may be at a greater risk for the development of alcohol-related problems due to their lack of control over drinking.

For men, our findings propose a theoretical pattern of relationships consistent with the Hyperarousability Theory for why victims of sexual abuse have a higher likelihood of experiencing PTSD and, in turn, may be unable to regulate their self-proscribed drinking limits. Drinking beyond one's limits can thereby increase not only one's alcohol use but alcohol-related problems as well. We are suggesting emotions brought on by triggering events or people, which are typical among those experiencing PTSD symptoms, contribute to more IC.

Additionally, childhood emotional abuse may increase the likelihood of the development of PTSD and increased levels of impaired control, which may contribute to the development of problematic drinking behaviors for both genders. One key finding is that individuals with a history of childhood emotional abuse may be at a greater risk for alcohol-related problems due to their PTSD symptoms, as well as their uncontrolled approach to drinking among college students. Our findings suggest that the emotional abuses may have a stronger impact than the actual bruises when both emotional and physical abuses were together in the same model. More research is needed on the importance of emotional abuse in relation to AUDs (alcohol use disorders), but our findings point to new possibilities for therapeutic intervention focusing on the emotional ramifications of childhood trauma for college student populations.

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Author contributions

Dr. Patock-Peckham wrote the protocol, handled all paperwork regarding the IRB, supervised the data collection, handled the data management, conducted analyses, and wrote and edited a substantial portion of the manuscript. Drs. Patock-Peckham and Mr. Daniel Belton are responsible for the model and much of the literature review. Mr. Belton did write the section on trauma. Mr. John Curtis assisted with data collection and the literature review. Drs. Patock-Peckham and Tein are responsible for the multiple group SEM model and all the analyses. Drs. Patock-Peckham, D'Ardenne and students Daniel Belton and Dylan Bauman (prepared tables and figures) were responsible for writing and preparing the manuscript. Drs. Sanabria contributed significantly to the introduction of the manuscript. Dr. McClure contributed to and made edits to the discussion section. Dr. Morgan-Lopez edited an earlier version of this same idea years ago with these same variables that did not moderate on gender.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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