



Avoidance Coping as a Vulnerability Factor for Negative Drinking Consequences Among Injury Survivors Experiencing PTSD Symptoms: An Ecological Momentary Assessment Study

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ABSTRACT

The purpose of this study was to examine the dynamic relationships between daily PTSD symptom severity (PTSS), cognitive and behavioral avoidance coping, and negative drinking consequences following recent injury. Participants consisted of 36 injury survivors ($M_{\text{age}} = 34.0$, $SD = 10.8$; 75.0% male; 69.4% White) who completed thrice daily assessments of PTSS, avoidance coping, and negative drinking consequences for 7 days at 6-weeks post-injury. Although hypothesized relationships were not statistically significant in full models with covariates that included alcohol consumption, the confidence intervals associated with focal predictors provided support for predictions. Follow-up analyses without covariates indicated that on occasions when an injury survivor engaged in more avoidance coping and experienced higher levels of PTSS, negative drinking consequences increased by 9% ($b = 0.02$, $SE = 0.01$, $p = .006$). This interaction was primarily driven by cognitive avoidance coping ($b = 0.03$, $SE = 0.01$, $p = .008$). Routine screening of avoidance coping, PTSS, and alcohol consumption in the aftermath of recent injury might assist with identifying survivors at risk for negative drinking consequences. Interventions that address cognitive avoidance coping and drinking among survivors experiencing elevated PTSS may help to prevent the development of this comorbidity.

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Introduction

In the United States (US) population, over 40% of people with PTSD also experience an alcohol use disorder (AUD) as defined in the *Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV)* (Pietrzak et al. 2011). People with PTSD and problematic drinking encounter more severe impairment compared to people with either PTSD or AUD alone (Riggs et al. 2003). The *self-medication hypothesis* (Hruska and Delahanty 2014) is a common explanation for PTSD and alcohol use co-occurrence and purports that PTSD prompts drinking to relieve trauma-related distress.

Research supports the self-medication hypothesis. Observational research indicates that PTSD symptom severity (PTSS), representing how bothered a person is by their PTSD symptoms, mediates the relationship between childhood trauma and adulthood alcohol problems (Patock-Peckham et al. 2020). Evidence from laboratory-based experimental research indicates that people with PTSD and AUD show greater craving, distress, and physiological reactivity when presented with

trauma- and alcohol-cues together, compared to trauma- or alcohol-cues alone (Coffey et al. 2010). This suggests that drinking (subsequent to craving) may occur when experiencing trauma-related distress. Finally, trauma-focused treatment produces alcohol and drug use reductions, but only given PTSS reductions (Hien et al. 2010).

Despite this support, the self-medication hypothesis does not explain why not every person with PTSD develops problematic drinking. The *stressor vulnerability model* addresses this problem by positing that stress motivates drinking among people with certain vulnerability factors such as drinking to cope, holding positive alcohol expectancies, or relying on avoidance coping (Cooper et al. 1992).

Avoidance coping represents an especially relevant factor for PTSD and problematic drinking given its association with both conditions. It consists of coping efforts that avoid stressor-related negative emotions and can be divided into cognitive or behavioral efforts (Moos and Holahan 2003). Cognitive avoidance coping involves denying, minimizing, or refusing to accept the

stressor, while behavioral avoidance coping involves venting negative emotions and engaging in impulsive or risky behaviors (Moos and Holahan 2003). Avoidance coping following trauma predicts greater risk for subsequent PTSD, particularly when already experiencing an AUD (Hruska et al. 2011). Furthermore, reductions in avoidance coping among people seeking addiction treatment predict subsequent alcohol abstinence (Timko, Finney, and Moos 2005).

Despite support for avoidance coping as an important vulnerability factor for problematic drinking among trauma-exposed individuals, existing research has relied on survey-based designs testing *inter-individual* differences representing *between-person* associations. However, coping is a dynamic process that varies across the day within the same person, necessitating a research design that allows for testing *intra-individual* differences and the *within-person* relationships among avoidance coping, PTSS, and drinking behavior (Litt, Tennen, and Affleck 2010).

Ecological momentary assessment (EMA) allows for this consideration by collecting data one or more times per day under real-world conditions. Prior EMA research suggests that alcohol drinking occurs during PTSS exacerbations when avoidance coping is also elevated (Possemato et al. 2015). However, this research is limited to alcohol consumption. A growing body of research indicates that negative drinking consequences (problems from drinking), rather than alcohol consumption, are more strongly associated with PTSS, warranting their examination in the context of coping (Gaher et al. 2014; Hruska et al. 2017; McDevitt-Murphy et al. 2015; Stappenbeck et al. 2013). Furthermore, past research has focused on Veterans with trauma in the distant past and thus does not indicate how the relationship between PTSS, avoidance coping, and problematic alcohol use unfolds in relation to a *recent* traumatic event. A greater understanding of these inter-relationships in the acute trauma phase can inform early intervention efforts, thereby preventing the impairment associated with drinking in the context of trauma symptoms. Finally, existing research has not distinguished between cognitive and behavioral avoidance coping strategies, even though these strategies may differentially inform acute interventions.

The current study used EMA to examine the relationships between daily PTSS, cognitive and behavioral avoidance coping, and negative drinking consequences among injury survivors 6-weeks post-injury. PTSD is one of the most common psychological disorders following injury (Bryant et al. 2010). Thus, injury survivors represent an ideal population to examine how avoidance coping relates to PTSS and drinking in the acute post-

trauma period. We hypothesized that the relationship between PTSS and negative drinking consequences would be strongest when survivors reported more reliance on avoidance coping. Based upon the limited research examining cognitive and behavioral coping strategies separately as they relate to PTSS (Tiet et al. 2006; Ullman et al. 2007), we predicted that this relationship would be most pronounced for cognitive avoidance coping.

Methods

Participants

Participants were 36 injury survivors admitted to an Adult Level I Trauma Center in the Midwest. Participants were 34 years old on average ($SD = 10.8$), mostly male (75.0%), White (69.4%; 30.6% Black), and with some college or a 2-year degree (36.1%). The injuries experienced were the result of motor vehicle/cycle crashes (41.2%; e.g., lacerations, broken/fractured bones, whiplash), falls/accidents (35.2%; e.g., contusions, broken/fractured bones), and acts of violence (26.2%; e.g., lacerations, gunshot wounds, contusions),

Procedure

Study procedures were approved by the Human Subjects Review Boards of Summa Health System (Akron, OH) and Kent State University (Kent, OH). The study's procedures have been previously published (Hruska et al. 2017). In brief, recruitment occurred during a routine medical follow-up for injury survivors hospitalized 2-weeks earlier ($M = 2.39$, $SD = 0.83$). Inclusion criteria included: being 18–65 years old; living ≤ 30 miles of the hospital; having a Glasgow Coma Scale score > 13 when admitted to the trauma center; and meeting *DSM-IV* Criterion A of the PTSD diagnosis in relation to the injury that was experienced (i.e., reporting that the injury involved death or threat of death to the self or others and reporting feeling fear, helpless, or horror in response to the injury) (American Psychiatric Association 2000). Injury survivors meeting initial criteria received a description of the study; those interested were screened to further determine eligibility. Qualifying patients provided written informed consent. Eighty-four individuals met eligibility criteria and 80 (95.2%) consented.

At 6-weeks post-injury ($M = 6.53$, $SD = 1.00$), 68 participants (85.0%) were retained. We further restricted the sample to survivors reporting drinking on ≥ 1 occasion during daily data collection, producing a final

sample of $N = 36$. No differences emerged on age, sex, race, education, or hospital stay length between those in the final sample compared to those not retained (p 's $> .05$).

Participants completed 3 assessments per day for 7 days starting 6-weeks post-injury using a personal digital assistant (PDA) that was delivered to participants in person by the research team. Participants were trained on the PDA's operations and engaged in a practice assessment. Assessments occurred randomly in the morning (10:00AM–11:30AM), afternoon (3:00PM–4:30PM), and evening (8:00PM–9:30PM) based upon an established protocol (Todd et al. 2005). All assessments asked participants to report symptoms, coping, or drinking behavior that had occurred since the last assessment.

Participants were compensated \$40 plus entries into a raffle for one of three \$100 gift cards to a local grocery store. Entries were earned based upon the number of assessments completed: 0%–25% complete assessments = 2 entries, 26%–50% = 4 entries, 51%–75% completed assessments = 6 entries, 76%–100% complete assessments = 8 entries. Completing 100% of the assessments earned participants an additional 2 entries toward the raffle. Thus, participants had the chance to earn a grand total of 10 entries. The raffle was conducted at the end of the study after data collection was complete (Hruska et al. 2017).

Measures

PTSS

The 6-item Short Form PTSD Checklist [20] assessed daily PTSS. Participants referenced the event that “recently caused you to be hospitalized” and rated how much they had been bothered by each symptom since the last assessment (1 “Not at all” to 5 “A lot”). Consistent with past research, response ratings were summed for each assessment to yield a symptom severity measure (possible range: 6–30) (Marshall, Miles, and Stewart 2010; Stanley et al. 2019).

Avoidance coping

The 12-item avoidance coping subscale of the Coping Response Inventory (Moos 1993) assessed daily avoidance coping; 6 items assessed cognitive strategies (e.g., wishing your problem will go away, denying the seriousness of the problem) and 6 assessed behavioral strategies (e.g., yelled or shouted to let off steam, took your anger out on other people) (Moos and Holahan 2003). These avoidance coping subscales are valid and superior to a single avoidance coping factor (Blalock and Joiner 2000). At each assessment, participants

indicated “how much you have used the coping strategy described to deal with the problems or difficulties you may be experiencing because of your injury.” Participants rated how frequently they had been using each strategy since the last assessment (0 “I did not do this at all” to 3 “I did this fairly often”). Response ratings were summed for each assessment (possible range: 0–36).

Negative drinking consequences

Consistent with past research (Simons et al. 2005; Wray, Merrill, and Monti 2014), 10 of the most frequently endorsed items from the Drinker Inventory of Consequences were used to measure drinking consequences (Miller, Tonigan, and Longabaugh 1995). Participants indicated if they: “acted impulsively and regretted it,” “failed to fulfill expectations,” “got sick and vomited,” “spent too much money,” “lost a lot of money,” “said/did embarrassing things,” “took foolish risks,” “felt hungover,” “felt bad about yourself,” or “felt unhappy” due to drinking alcohol. The statement “neglected responsibilities” was also included (Simons et al. 2005). These 11 items were summed to produce a total count of negative drinking consequences (possible range: 0–11).

Covariates

Alcohol consumption was assessed with a single item asking participants how many alcoholic beverages they had consumed since the previous assessment (0–10 or more drinks). Sex (0 = “male,” 1 = “female”) was assessed using a single item and assessment timing was represented as a categorical variable (0 = “morning,” 1 = “afternoon,” 2 = “evening”). Alcohol consumption and sex were included given their empirical relationships with negative drinking consequences (Miller, Tonigan, and Longabaugh 1995); assessment timing was included given the potential effects of the different times of the day when the assessments were delivered.

Data analysis

Analyses were performed using Stata IC 13 (StataCorp 2013). We first examined the mean (M), standard deviation (SD), within-person standard deviation (iSD), and mean-squared successive difference ($MSSD$) of the variables. The M and SD were calculated using person means and provide a between-person measure of the variables' average and dispersion. The iSD was calculated by taking the average of all within-person SD s; this indicates within-person variability across the sampling period (Almeida et al. 2020). The $MSSD$ was calculated using the average of all squared successive observations

for each participant. It provides a measure of temporal fluctuation (Jahng, Wood, and Trull 2008).

Generalized linear mixed models using a Poisson error distribution and log link function were used to evaluate hypotheses. We first tested an intercept-only model to obtain the intraclass correlation coefficient. This was followed by two primary models consisting of covariates and the focal predictors to test: 1) the relationships between PTSS, overall avoidance coping, and drinking consequences; and 2) the relationships between PTSS, cognitive and behavioral avoidance coping separately, and drinking consequences. Main effects were considered first followed by interactions. We then performed follow-up analyses without covariates. Categorical variables (sex, assessment timing) were represented as dummy variables using Stata's factor variable notation (StataCorp n.d.). Simple slope analyses were conducted to interpret interactions (Spiller et al. 2012). High and low avoidance coping was defined as the 75th and 25th percentile of each person's coping estimate. Level-1 predictors were person-mean centered. Effect sizes were reported using the incident rate ratio (IRR), which indicates the likelihood of observing drinking consequences given a 1-unit change in PTSS.

We evaluated our hypothesized relationships using two approaches: 1) traditional null hypothesis significance testing; and 2) interpretation of the 95% confidence intervals (CIs) associated with the focal predictors' effect size estimates (IRRs). CIs provide the distribution of plausible values associated with a parameter estimate (Cumming 2014). If a study were to be repeated over many instances, the 95% CI provides the range of values that would be expected to be observed in 95% of the replications (Cumming and Finch 2005). Because more plausible values lie near the middle of a 95% CI's distribution, if most values fall outside of the value associated with the null hypothesis, it provides support for its rejection and evidence for the plausibility of the alternative hypothesis (Cumming 2007).

Applying this to the present study, when most values in the focal variable IRRs' 95% CIs were greater than 1.00, it served as support for our predictions. The advantage of this approach is that it avoids the dichotomous decision-making associated with null hypothesis significance testing and thus offers a more sensitive assessment of a study's hypotheses (Cumming and Fidler 2009). CI

assessment was performed using the "catseyes" package (Anderson 2020) in R 4.1.2. (R Core Team 2021).

Results

Preliminary analyses

Comparable to other EMA studies, participants completed 72.2% of the assessments (546/756) (Fisher and To 2012). All 36 participants provided data: 28 contributed data on all 7 days; 5 on 6 days; 2 on 4 days; and 1 on 3 days. Thus, most participants provided data on all days, and every participant contributed data on at least 3 of the 7 study days.

All participants completed their assessments within timeframes required by the protocol. The average time lags between assessments were as follows: morning-to-afternoon = 5.09 hours ($SD = 0.60$, Range = 3.68, 6.48), afternoon-to-evening = 4.98 hours ($SD = 0.63$, Range = 3.68–6.33), evening-to-morning = 13.92 ($SD = 0.59$, Range = 12.67–15.40).

Medication usage at 6 weeks was not common, as only 6 participants reported using medication. One participant reported using aspirin. No other pain medications were reported.

Descriptive statistics and bivariate correlations

Drinking occurred on 35.7% of days and 21.8% of the assessments (Males = 17.4%; Females = 4.4%). When drinking happened, participants consumed ~3 drinks ($M = 2.85$, range = 1–10; Males = 2.80, range = 1–10; Females = 3.08, range = 1–10). Overall, 13 participants (36.1%; 10 males, 3 females) engaged in binge drinking (≥ 4 drinks for females and ≥ 5 drinks for males). While this rate exceeds the 16.7% prevalence rate of binge drinking in the general population (Centers for Disease Control and Prevention 2022), this is likely due to the restriction we placed for inclusion in the analytic sample (≥ 1 drink during the daily data collection). Including all participants, regardless of their alcohol consumption, reduces this prevalence rate to 19.1%, which is more consistent with the national US rate (Centers for Disease Control and Prevention 2022). Among those who engaged in binge drinking, binge drinking occurred on 22/252 days that data collection occurred (18 days males, 4 days females). Participants reported ≥ 1 drinking consequence on 14.7% of days, representing 10.6% of the assessments (Males: 8.9%; Females: 1.6%). This is comparable to young adults

Table 1. Descriptive statistics and bivariate correlations among the study's variables.

Variable	1.	2.	3.	4.	5.	6.	7.	8	<i>M</i>	<i>Range</i>	<i>SD</i>	<i>iSD</i>	<i>MSSD</i>
1. Negative Drinking Consequences	1.00	0.59***	0.46***	0.52***	0.44***	0.54***	−0.08	0.02	0.43	0–9	1.56	0.23	0.48
2. Alcohol Consumption	0.28***	1.00	0.34***	0.41***	0.39***	0.33***	−0.06	0.01	0.69	0–5.5	0.98	1.14	3.74
3. PTSS	0.19***	0.12**	1.00	0.89 ***	0.78 ***	0.87 ***	−0.01	−0.01	10.83	6–29.27	5.78	1.89	8.33
4. <i>AVC</i> _{Overall}	0.22***	0.18***	0.39***	1.00	0.96 ***	0.80 ***	0.14**	0.02	8.81	0–33.75	8.43	2.89	13.04
5. <i>AVC</i> _{Cog}	0.14***	0.11**	0.27***	0.87 ***	1.00	0.61 ***	0.18***	0.01	6.34	0–17.33	5.70	2.08	7.12
6. <i>AVC</i> _{Beh}	0.23***	0.18***	0.38***	0.71 ***	0.27 ***	1.00	−0.01	0.02	2.48	0–17.25	3.52	1.41	4.23
7. Sex	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	–	–	–	–	–
8. Assessment Timing	−0.05	0.03	0.10	−0.01	−0.02	0.01	0.00	1.00	–	–	–	–	–

Note. The mean (*M*) and standard deviation (*SD*) were calculated using person means and thus provide a between-person measure of the average and variability of the study's variables; the within-person standard deviation (*iSD*) was calculated by taking the average of all within-person *SD*s and thus provides an indication of within-person variability (Almeida et al. 2020); the mean-squared successive difference (*MSSD*) was calculated by taking the average of all squared successive observations for each participant and thus offers a measure of fluctuation across time (Jahng, Wood, and Trull 2008). Correlations above the diagonal represent between-person relationships and were computed using the person means of the variables; they represent the average relationships across the entire sample over the entire sampling period. Correlations below the diagonal represent within-person relationships and represent the average relationship within each person on an average day; they include 540 daily assessments and were computed using within-person centered variables. *PTSS* = PTSD symptom severity, *AVC*_{Overall} = overall avoidance coping, *AVC*_{Cog} = cognitive avoidance coping, *AVC*_{Beh} = behavioral avoidance coping.

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

attending college (Simons et al. 2005) and is notable since most participants in the current study were in their 30s, when at-risk drinking decreases (National Institute on Alcohol Abuse and Alcoholism 2006). Approximately 3 consequences ($M = 2.86$, range = 1–9; Males: $M = 2.92$, range = 1–9; Females: $M = 2.56$, range = 1–7) were reported when consequences occurred.

Regarding PTSS, the observed values nearly spanned the full range of the SF-PCL. Consistent with prior injury survivor research, most participants experienced moderate symptom levels (Zatzick et al. 2002). In addition, greater use of cognitive, relative to behavioral, avoidance coping strategies were reported. While the *SD* and *iSD* values on all variables suggested greater variability between- compared to within-participants, the *MSSD* values were all positive indicating the presence of fluctuations across time.

Correlations representing between- and within-person relationships appear above and below the diagonal in Table 1. The between-person correlations reflect the average relationship between the variables across the sample over the sampling period; the within-person correlations reflect the average relationship within each person on an average occasion. At the between-person level, participants reporting higher levels of PTSS and greater overall, cognitive, and behavioral avoidance coping strategies also reported more drinking consequences across the sampling period. Similarly, at the within-person level, occasions characterized by higher PTSS and higher overall, cognitive, and behavioral avoidance coping

compared to their average were associated with more negative drinking consequences on those occasions. Notably, alcohol consumption was the only covariate associated with drinking consequences (in a positive direction at both levels).

Intraclass correlation coefficient (ICC)

The ICC was .87 (95% CI = .81, .92). Thus, 87% of the variance in negative drinking consequences was attributable to between-person differences, and 13% to within-person differences.

Relationship between PTSS and overall avoidance coping on negative drinking consequences

Neither PTSS nor overall avoidance coping had statistically significant relationships with drinking consequences (see Table 2).¹ However, the CIs associated with these relationships indicated that most values were positive, providing support for our predictions (see Figure 1). In the follow-up model without covariates, avoidance coping was associated with negative drinking consequences (see Table 3). For the average person, each unit increase on avoidance coping was associated with 9% more drinking consequences.

The interaction between PTSS and overall avoidance coping was not statistically significant (see Table 2). However, the CI associated with this interaction suggested that the true value of this estimate

Table 2. Multilevel poisson model examining the relationship between daily PTSS, overall avoidance coping, negative drinking consequences: full model with covariates ($N = 36$).

	Main Effects				Interaction			
	<i>b</i>	IRR	95% CI	<i>p</i>	<i>b</i>	IRR	95% CI	<i>p</i>
Fixed Effects								
Intercept	−4.03	0.02	0.01, 0.08	<.001	−4.03	0.02	0.01, 0.08	<.001
PTSS	0.06	1.06	0.99, 1.13	.08	0.05	1.06	0.99, 1.13	.11
AVC _{Overall}	0.03	1.03	0.98, 1.08	.22	0.03	1.03	0.98, 1.08	.23
PTSS x AVC _{Overall}	—	—	—	—	0.01	1.01	0.99, 1.02	.36
Alcohol Consumption	0.18	1.19	1.09, 1.30	<.001	0.16	1.17	1.07, 1.29	.001
Sex	−0.10	0.91	0.12, 6.79	.92	−0.12	0.89	0.12, 6.64	.91
Assessment Timing								
Afternoon	0.02	1.02	0.69, 1.52	.91	0.01	1.01	0.68, 1.50	.95
Evening	−0.34	0.71	0.48, 1.05	.09	−0.31	0.72	0.49, 1.09	.12
Random Effects								
Intercept	8.43	—	3.36, 21.15	<.001	8.31	—	3.31, 20.87	—
−2 log likelihood	407.11	—	—	—	406.27	—	—	—

Note. PTSS = PTSD symptom severity, AVC_{Overall} = overall avoidance coping, IRR = incident rate ratio; Sex was coded as a dichotomous variable with 0 = “male” and 1 = “female,” Assessment Timing was coded as a trichotomous variables with 0 = “morning,” 1 = “afternoon,” and 2 = “evening;” the model included 540 daily assessments.

was positive (see Figure 1). In the model without covariates, there was a statistically significant interaction between PTSS and avoidance coping (See Table 3). According to the simple effects, PTSS and negative drinking consequences were related at high ($b = 0.09$, $IRR = 1.09$, 95% CI = 1.02, 1.17, $p = .009$), but not low levels of avoidance coping ($b = 0.02$, $IRR = 1.02$, 95% CI = 0.95, 1.09, $p = .66$). For the average person, each unit increase in PTSS was associated with a 9% increase in the number of negative consequences reported at occasions when avoidance coping was elevated.

Relationship between PTSS, cognitive and behavioral avoidance coping, and negative drinking consequences

PTSS, cognitive, and behavioral avoidance coping did not have statistically significant relationships with drinking consequences (See Table 4). The CIs associated with PTSS and cognitive avoidance coping suggested that the true values of these estimates were positive (see Figure 1). When we examined this model without covariates, we found that neither PTSS nor cognitive avoidance coping were independently associated with

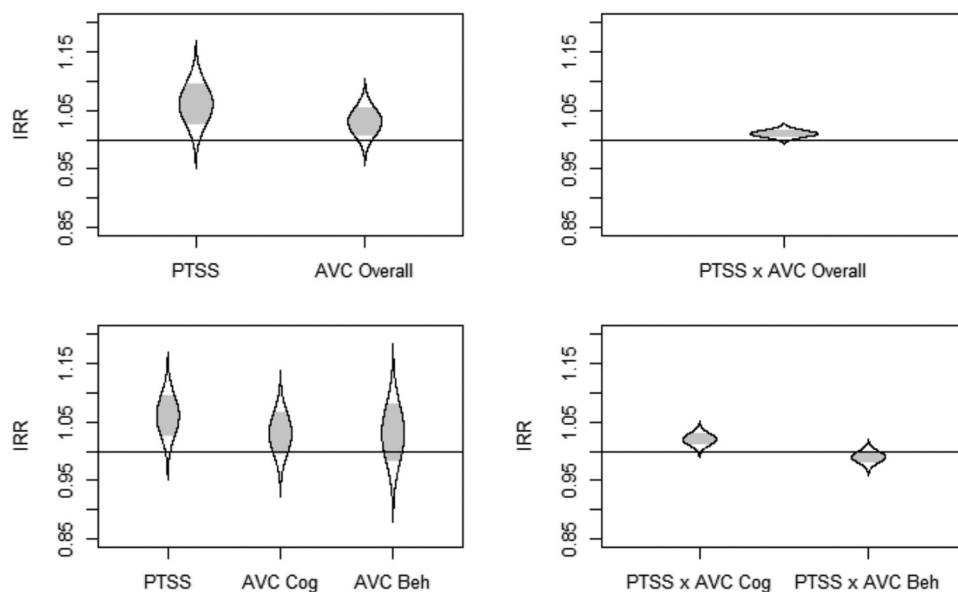


Figure 1. Distribution of values in the 95% confidence intervals associated with the focal predictors testing the study's predictions. **Note:** The shaded portion of each confidence interval represents the location of 95% of the values in the interval. A horizontal line at $Y = 1.00$ is included in each graph as a point of reference (An IRR equal to 1.00 indicates no relationship between the predictor and outcome). IRR = incidence rate ratio; PTSS = PTSD symptom severity; AVC Cog = cognitive avoidance coping; AVC Beh = behavioral avoidance coping.

Table 3. Multilevel poisson model examining the relationship between daily PTSS, overall avoidance coping, and negative drinking consequences: supplemental model without covariates ($n = 36$).

	Main Effects				Interaction			
	<i>b</i>	IRR	95% CI	<i>p</i>	<i>b</i>	IRR	95% CI	<i>p</i>
Fixed Effects								
Intercept	−4.42	0.01	0.01, 0.04	<.001	−4.16	0.02	0.01, 0.06	<.001
PTSS	0.05	1.05	0.98, 1.12	.14	0.05	1.05	0.99, 1.12	.11
AVC _{Overall}	0.09	1.09	1.05, 1.13	<.001	0.05	1.06	1.01, 1.10	.02
PTSS x AVC _{Overall}	–	–	–	–	0.02	1.02	1.01, 1.03	.006
Random Effects								
Intercept	4.35	–	1.58, 12.03	–	8.22	–	3.27, 20.68	–
−2 log likelihood	419.01	–	–	–	418.33	–	–	–

Note. PTSS = PTSD symptom severity, AVC_{Overall} = overall avoidance coping, IRR = incident rate ratio; the model included 540 daily assessments.

Table 4. Multilevel poisson model examining the interaction between daily PTSS, cognitive and behavioral avoidance coping, and negative drinking consequences: full model with covariates ($N = 36$).

	Main Effects				Interaction			
	<i>b</i>	IRR	95% CI	<i>p</i>	<i>b</i>	IRR	95% CI	<i>p</i>
Fixed Effects								
Intercept	−4.03	0.02	0.01, 0.08	<.001	−4.03	0.02	0.01, 0.08	<.001
PTSS	0.06	1.06	0.99, 1.13	.08	0.07	1.07	1.00, 1.15	.04
AVC _{Cog}	0.03	1.03	0.96, 1.10	.42	0.03	1.03	0.96, 1.11	.37
AVC _{Beh}	0.03	1.03	0.94, 1.13	.51	0.03	1.03	0.94, 1.13	.55
PTSS x AVC _{Cog}	–	–	–	–	0.02	1.02	1.00, 1.05	.06
PTSS x AVC _{Beh}	–	–	–	–	−0.01	0.99	0.97, 1.01	.44
Alcohol Consumption	0.17	1.19	1.09, 1.31	<.001	0.16	1.18	1.07, 1.30	.001
Sex	−0.09	0.91	0.12, 6.82	.93	−0.09	0.92	0.12, 6.83	.93
Assessing Timing								
Afternoon	–	1.02	0.68, 1.52	.92	−0.02	0.98	0.66, 1.47	.93
Evening	–	0.71	0.48, 1.06	.09	−0.34	0.71	0.48, 1.07	.10
Random Effects								
Intercept	8.42	–	3.36, 21.12	–	8.26	–	3.29, 20.75	–
−2 log likelihood	407.08	–	–	–	403.61	–	–	–

Note. PTSS = PTSD symptom severity, AVC_{Cog} = cognitive avoidance coping, AVC_{Beh} = behavioral avoidance coping, IRR = incident rate ratio; Sex was coded as a dichotomous variable with 0 = "male" and 1 = "female," Assessment Timing was coded as a trichotomous variables with 0 = "morning," 1 = "afternoon," and 2 = "evening;" the model included 539 daily assessments.

Table 5. Multilevel poisson model examining the interaction between daily PTSS, cognitive and behavioral avoidance coping, and negative drinking consequences: supplemental model without covariates ($N = 36$).

	Main Effects				Interaction			
	<i>b</i>	IRR	95% CI	<i>p</i>	<i>b</i>	IRR	95% CI	<i>p</i>
Fixed Effects								
Intercept	−4.15	0.02	0.01, 0.06	<.001	−4.17	0.02	0.01, 0.06	<.001
PTSS	0.05	1.05	0.99, 1.12	.10	0.07	1.07	1.01, 1.15	.04
AVC _{Cog}	0.03	1.03	0.97, 1.09	.38	0.03	1.03	0.97, 1.10	.31
AVC _{Beh}	0.12	1.13	1.05, 1.22	.002	0.09	1.09	1.00, 1.19	.06
PTSS x AVC _{Cog}	–	–	–	–	0.03	1.03	1.01, 1.05	.008
PTSS x AVC _{Beh}	–	–	–	–	0.01	1.01	0.98, 1.02	.81
Random Effects								
Intercept	8.52	–	3.39, 21.38	–	8.19	–	3.25, 20.62	–
−2 log likelihood	422.85	–	–	–	415.28	–	–	–

Note. PTSS = PTSD symptom severity, AVC_{Cog} = cognitive avoidance coping, AVC_{Beh} = behavioral avoidance coping, IRR = incident rate ratio; the model included 539 daily assessments.

negative drinking consequences (see Table 5). In contrast, behavioral avoidance coping had a positive association. On occasions when a person's behavioral avoidance coping was 1 unit higher than their personal average, they reported a 13% increase in the number of negative drinking consequences at that occasion.

Neither interaction between PTSS and the two dimensions of avoidance coping was statistically significant (see Table 4), but the CI associated with the PTSS-avoidance coping interaction indicated that this relationship was positive (see Figure 1). In the model without covariates, this interaction was statistically

significant (see Table 5). At higher levels of cognitive avoidance coping, each unit increase in PTSS for the average person was associated with a 14% increase in the number of negative drinking consequences reported ($b = 0.13$, $IRR = 1.14$, 95% CI = 1.04, 1.24, $p = .004$). The relationship between PTSS and negative drinking consequences was not statistically significant when avoidance coping was low ($b = 0.03$, $IRR = 1.03$, 95% CI = 0.97, 1.10, $p = .37$). This pattern of findings remained after removing the items representing avoidance PTSS symptoms. The interaction between PTSS and cognitive avoidance coping was also statistically significant ($b = 0.03$, $IRR = 1.04$, 95% CI = 1.01, 1.07, $p = .02$), while the interaction between PTSS and behavioral avoidance coping was not statistically significant ($b = 0.01$, $IRR = 1.01$, 95% CI = 0.98, 1.04, $p = .67$).

Discussion

The current study considered how daily fluctuations in overall, cognitive, and behavioral avoidance coping following recent injury contribute to negative drinking consequences. While the hypothesized relationships were not statistically significant, the CIs associated with these relationships were consistent with predictions. If this study was replicated many times, we would on average expect to observe relationships in the direction of our hypotheses (Cumming and Finch 2005). Furthermore, in the follow-up models without covariates, we found that on occasions when a person experienced elevated PTSS and more avoidance coping than usual, negative drinking consequences were more likely. The relationships observed in the follow-up analyses suggest that PTSS is not as strongly associated with negative drinking consequences as alcohol consumption – the only covariate associated with drinking consequences. This makes sense given that alcohol consumption is a necessary antecedent to drinking consequences. Thus, the sample size in the current study may not have been sufficient to detect statistically significant relationships between the focal predictors and consequences given the strength of the relationship between alcohol consumption and drinking consequences.

Our findings without controlling for alcohol consumption are similar to the results of Possemato and colleagues (Possemato et al. 2015) in which avoidance coping fluctuations corresponded with drinking fluctuations among people experiencing PTSS from a distal trauma. Relatedly, we found similar increases in our outcome, such that occasions with PTSS elevations were associated with 9% more *negative drinking*

consequences, while Possemato and colleagues (Possemato et al. 2015) found that PTSS elevations were associated with a 6% increase in *alcohol drinking*.

We also found evidence that behavioral avoidance coping is more associated with drinking consequences independent of PTSS. Because drinking consequences result from drinking behaviors, behavioral avoidance coping may be related to this outcome regardless of PTSS level given their common behavioral dimension. Aside from this effect, we observed that the combination of elevated PTSS *and* more cognitive, but not behavioral, avoidance coping was associated with drinking consequence elevations. This is consistent with existing research showing that cognitive avoidance coping is particularly associated with PTSS (Tiet et al. 2006; Ullman et al. 2007). Further, factor analytic studies of psychopathology demonstrate that even though PTSD includes behavioral symptoms, it is more similar to psychiatric disorders characterized by cognitive distortions representing internalizing symptoms (Gustavson et al. 2020). Perhaps cognitive avoidance coping is most related to drinking consequences when PTSS are elevated given their common cognitive dimension.

Our findings have implications for interventions with recent injury survivors. For example, stepped care approaches deliver triaged care dependent upon risk and psychiatric distress in the weeks and months post-injury (O'Donnell et al. 2008). This entails screening survivors at regular intervals to identify those at risk and providing an escalating infusion of resources according to the length of time post-injury (O'Donnell et al. 2008).

Although stepped care includes AUD treatment elements, to date it has only produced a significant reduction in PTSD vs. AUD risk (Zatzick et al. 2021). This could be due to the challenge of incorporating treatment components for multiple mental health disorders in a short time span. Given the observed association between alcohol consumption and drinking consequences, screening for risky alcohol consumption may represent an important first line of evaluation to identify injury survivors who may benefit from intervention content targeting drinking reduction. On the other hand, coping effort screening and intervention delivery targeting cognitive avoidance coping for injury survivors experiencing elevated PTSS may improve stepped care intervention efforts, while targeting behavioral avoidance coping might be important for survivors regardless of PTSS.

Several limitations should be noted. First, future research should consider daily fluctuations in avoidance coping, PTSS, and alcohol outcomes over longer time

periods post-injury to determine how the relationships observed vary across time. Second, the study's outcomes were measured via self-report. Third, participants in the study predominantly identified as White or Black, limiting generalizability. However, the racial composition of the study is consistent with other US studies with injury survivors (Prekker et al. 2009). Fourth, we did not collect information on the type of alcohol that was consumed. Finally, a relatively small sample might have limited our ability to detect relationships between PTSS, coping, and alcohol consumption. Variability was present in the amount of drinking that occurred including notable differences between males and females. This variability, in the context of our sample size, may help to explain why we did not detect relationships with alcohol consumption. That being said, our findings are consistent with prior research using larger samples showing that PTSS is more strongly related to alcohol consequences than alcohol consumption (Gaher et al. 2014; McDevitt-Murphy et al. 2015; Stappenbeck et al. 2013).

Despite these limitations, the present study represents the first examination of daily avoidance coping as a vulnerability factor contributing to negative drinking consequences among recent injury survivors. Furthermore, it has the capacity to inform future intervention efforts addressing PTSD and alcohol use following injury and thereby assist with preventing the significant impairment that accompanies the co-occurrence of these conditions.

Notes

1. Because participants were asked to report on their experiences since the last assessment and because the time lag between assessments could vary between participants due to the protocol schedule, we also tested full models with covariates plus the time lag between assessments. The statistical significance of the main effects associated with PTSS ($IRR = 1.06$, $SE = 0.04$, $p = .09$; $IRR = 1.06$, $SE = 0.04$, $p = .09$), overall avoidance coping ($IRR = 1.03$, $SE = 0.03$, $p = .20$), cognitive avoidance coping ($IRR = 1.03$, $SE = 0.04$, $p = .45$), and behavioral avoidance coping ($IRR = 1.04$, $SE = 0.05$, $p = .41$) were unchanged. The statistical significance of the PTSS-avoidance coping ($IRR = 1.01$, $SE = 0.01$, $p = .35$), PTSS-cognitive avoidance coping ($IRR = 1.02$, $SE = 0.01$, $p = .06$), and PTSS-behavioral avoidance coping ($IRR = 0.99$, $SE = 0.01$, $p = .39$) interactions were also unchanged. Because the inclusion of a time lag variable results in a loss of information (no value can be calculated for the first day, first assessment for each participant), we report models without this variable to utilize all data available.

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References

- Almeida, D. M., D. Marcusson-Clavertz, D. E. Conroy, J. Kim, M. J. Zawadzki, M. J. Sliwinski, and J. M. Smyth. 2020. Everyday stress components and physical activity: Examining reactivity, recovery and pileup. *Journal of Behavioral Medicine* 43 (1):108–20. doi:10.1007/s10865-019-00062-z.
- American Psychiatric Association. 2000. *Diagnostic and statistical manual of mental disorders*. Vol. 4th ed. Text Revision. Washington, DC: American Psychiatric Association.
- Anderson, C. (2020). *Catseyes: Create catseye plots illustrating the normal distribution of the means* (R package version 0.2.5). <https://CRAN.R-project.org/package=catseyes>
- Blalock, J. A., and T. E. Joiner Jr. 2000. Interaction of cognitive avoidance coping and stress in predicting depression/anxiety. *Cognitive Therapy and Research* 24 (1):47–65. doi:10.1023/A:1005450908245.
- Bryant, R. A., M. L. O'Donnell, M. Creamer, A. C. McFarlane, C. R. Clark, and D. Silove. 2010. The psychiatric sequelae of traumatic injury. *The American Journal of Psychiatry* 167 (3):312–20. doi:10.1176/appi.ajp.2009.09050617.
- Centers for Disease Control and Prevention. 2022. *Binge drinking*. Alcohol and Public Health. <https://www.cdc.gov/alcohol/fact-sheets/binge-drinking.htm>.
- Coffey, S. F., J. A. Schumacher, P. R. Stasiewicz, A. M. Henslee, L. E. Baillie, and N. Landy. 2010. Craving and physiological reactivity to trauma and alcohol cues in posttraumatic stress disorder and alcohol dependence. *Experimental and Clinical Psychopharmacology* 18 (4):340–49. doi:10.1037/a0019790.
- Cooper, M. L., M. Russell, J. B. Skinner, M. R. Frone, and P. Mudar. 1992. Stress and alcohol use: Moderating effects of gender, coping, and alcohol expectancies. *Journal of Abnormal Psychology* 101 (1):139–52. doi:10.1037/0021-843X.101.1.139.
- Cumming, G. 2007. Inference by eye: Pictures of confidence intervals and thinking about levels of confidence. *Teaching Statistics* 29 (3):89–93. doi:10.1111/j.1467-9639.2007.00267.x.

- Cumming, G. 2014. The new statistics: Why and how. *Psychological Science* 25 (1):7–29. doi:10.1177/0956797613504966.
- Cumming, G., and F. Fidler. 2009. Confidence intervals: Better answers to better questions. *Zeitschrift für Psychologie/Journal of Psychology* 217 (1):15–26. doi:10.1027/0044-3409.217.1.15.
- Cumming, G., and S. Finch. 2005. Inference by eye: Confidence intervals and how to read pictures of data. *The American Psychologist* 60 (2):170–80. doi:10.1037/0003-066X.60.2.170.
- Fisher, C. D., and M. L. To. 2012. Using experience sampling methodology in organizational behavior: Experience sampling methodology. *Journal of Organizational Behavior* 33 (7):865–77. doi:10.1002/job.1803.
- Gaher, R. M., J. S. Simons, A. M. Hahn, N. L. Hofman, J. Hansen, and J. Buchkoski. 2014. An experience sampling study of PTSD and alcohol-related problems. *Psychology of Addictive Behaviors* 28 (4):1013–25. doi:10.1037/a0037257.
- Gustavson, D. E., C. E. Franz, M. S. Panizzon, M. J. Lyons, and W. S. Kremen. 2020. Internalizing and externalizing psychopathology in middle age: Genetic and environmental architecture and stability of symptoms over 15 to 20 years. *Psychological Medicine* 50 (9):1530–38. doi:10.1017/S0033291719001533.
- Hien, D. A., H. Jiang, A. N. C. Campbell, M. -C. Hu, G. M. Miele, L. R. Cohen, G. S. Brigham, C. Capstick, A. Kulaga, J. Robinson, et al. 2010. Do treatment improvements in PTSD severity affect substance use outcomes? A secondary analysis from a randomized clinical trial in NIDA's clinical trials network. *The American Journal of Psychiatry* 167 (1):95–101. doi:10.1176/appi.ajp.2009.09091261.
- Hruska, B., and D. L. Delahanty. 2014. PTSD-SUD biological mechanisms: Self-medication and beyond. In *Trauma and substance abuse: Causes, consequences, and treatment of comorbid disorders*, ed. P. Ouimette and J. P. Read, 2nd, 35–52. American Psychological Association. doi:10.1037/14273-003.
- Hruska, B., W. Fallon, E. Spoonster, E. M. Sledjeski, and D. L. Delahanty. 2011. Alcohol use disorder history moderates the relationship between avoidance coping and post-traumatic stress symptoms. *Psychology of Addictive Behaviors* 25 (3):405–14. doi:10.1037/a0022439.
- Hruska, B., M. L. Pacella, R. L. George, and D. L. Delahanty. 2017. The association between daily PTSD symptom severity and alcohol-related outcomes in recent traumatic injury victims. *Psychology of Addictive Behaviors* 31 (3):326–35. doi:10.1037/adb0000262.
- Jahng, S., P. K. Wood, and T. J. Trull. 2008. Analysis of affective instability in ecological momentary assessment: Indices using successive difference and group comparison via multilevel modeling. *Psychological Methods* 13 (4):354–75. doi:10.1037/a0014173.
- Litt, M. D., H. Tennen, and G. Affleck. 2010. *The dynamics of stress, coping, and health: Assessing stress and coping processes in near real time*. Oxford University Press. doi:10.1093/oxfordhb/9780195375343.013.0019.
- Marshall, G. N., J. N. V. Miles, and S. H. Stewart. 2010. Anxiety sensitivity and PTSD symptom severity are reciprocally related: Evidence from a longitudinal study of physical trauma survivors. *Journal of Abnormal Psychology* 119 (1):143–50. doi:10.1037/a0018009.
- McDevitt-Murphy, M. E., J. A. Fields, C. J. Monahan, and K. L. Bracken. 2015. Drinking motives among heavy-drinking veterans with and without posttraumatic stress disorder. *Addiction Research & Theory* 23 (2):148–55. doi:10.3109/16066359.2014.949696.
- Miller, W. R., J. S. Tonigan, and R. Longabaugh. 1995. *The drinker inventory of consequences (DrInc): An instrument of assessing adverse consequence of alcohol abuse*, Vol. 4. Bethesda, MD: National Institute of Alcohol Abuse and Alcoholism.
- Moos, R. H. 1993. *Coping responses inventory adult form*. Odessa, FL: Psychological Assessment Resources, Inc.
- Moos, R. H., and C. J. Holahan. 2003. Dispositional and contextual perspectives on coping: Toward an integrative framework. *Journal of Clinical Psychology* 59 (12):1387–403. doi:10.1002/jclp.10229.
- National Institute on Alcohol Abuse and Alcoholism. (2006). *Alcohol alert: Young adult drinking*. <https://pubs.niaaa.nih.gov/publications/aa68/aa68.htm>
- O'Donnell, M., R. Bryant, M. Creamer, and J. Carty. 2008. Mental health following traumatic injury: Toward a health system model of early psychological intervention. *Clinical Psychology Review* 28 (3):387–406. doi:10.1016/j.cpr.2007.07.008.
- Patock-Peckham, J. A., D. A. Belton, K. D'Ardenne, J. -Y. Tein, D. C. Bauman, F. J. Infurna, F. Sanabria, J. Curtis, A. A. Morgan-Lopez, and S. M. McClure. 2020. Dimensions of childhood trauma and their direct and indirect links to PTSD, impaired control over drinking, and alcohol-related-problems. *Addictive Behaviors Reports* 12:100304. doi:10.1016/j.abrep.2020.100304.
- Pietrzak, R. H., R. B. Goldstein, S. M. Southwick, and B. F. Grant. 2011. Prevalence and axis I comorbidity of full and partial posttraumatic stress disorder in the United States: Results from wave 2 of the national epidemiologic survey on alcohol and related conditions. *Journal of Anxiety Disorders* 25 (3):456–65. doi:10.1016/j.janxdis.2010.11.010.
- Possemato, K., S. A. Maisto, M. Wade, K. Barrie, S. McKenzie, L. J. Lantinga, and P. Ouimette. 2015. Ecological momentary assessment of PTSD symptoms and alcohol use in combat veterans. *Psychology of Addictive Behaviors* 29 (4):894–905. doi:10.1037/adb0000129.
- Prekker, M. E., J. R. Miner, E. G. Rockswold, and M. H. Biros. 2009. The prevalence of injury of any type in an urban emergency department population. *The Journal of Trauma* 66 (6):1688–95. doi:10.1097/TA.0b013e31817db0f1.
- R Core Team. 2021. *A language and environment for statistical computing*. R Foundation for Statistical Computing. <https://www.R-project.org>.
- Riggs, D. S., M. Rukstalis, J. R. Volpicelli, D. Kalmanson, and E. B. Foa. 2003. Demographic and social adjustment characteristics of patients with comorbid posttraumatic stress disorder and alcohol dependence: Potential pitfalls to PTSD treatment. *Addictive Behaviors* 28 (9):1717–30. doi:10.1016/j.addbeh.2003.08.044.
- Simons, J. S., R. M. Gaher, M. N. I. Oliver, J. A. Bush, and M. A. Palmer. 2005. An experience sampling study of associations between affect and alcohol use and problems

- among college students. *Journal of Studies on Alcohol* 66 (4):459–69. doi:10.15288/jsa.2005.66.459.
- Spiller, S. A., G. J. Fitzsimons, J. G. Lynch, and G. McClelland. 2012. Spotlights, floodlights, and the magic number zero: Simple effects tests in moderated regression. *Journal of Marketing Research* 50 (2):277–88. doi:10.1509/jmr.12.0420.
- Stanley, I. H., M. A. Hom, C. Chu, S. P. Dougherty, A. J. Gallyer, S. Spencer-Thomas, L. Shelef, E. Fruchter, K. A. Comtois, P. M. Gutierrez, et al. 2019. Perceptions of belongingness and social support attenuate PTSD symptom severity among firefighters: A multistudy investigation. *Psychological Services* 16 (4):543–55. doi:10.1037/ser0000240.
- Stappenbeck, C. A., M. Bedard-Gilligan, C. M. Lee, and D. Kaysen. 2013. Drinking motives for self and others predict alcohol use and consequences among college women: The moderating effects of PTSD. *Addictive Behaviors* 38 (3):1831–39. doi:10.1016/j.addbeh.2012.10.012.
- StataCorp. 2013. *Stata statistical software: Release 13*. StataCorp LLC.
- StataCorp. (n.d.). *Factor variables*. Retrieved April 11, 2022, from <https://www.stata.com/manuals/u11.pdf#u11.4.3Factorvariables>
- Tiet, Q. Q., C. Rosen, S. Cavella, R. H. Moos, J. W. Finney, and J. Yesavage. 2006. Coping, symptoms, and functioning outcomes of patients with posttraumatic stress disorder. *Journal of Traumatic Stress* 19 (6):799–811. doi:10.1002/jts.20185.
- Timko, C., J. W. Finney, and R. H. Moos. 2005. The 8-year course of alcohol abuse: Gender differences in social context and coping. *Alcoholism: Clinical & Experimental Research* 29 (4):612–21. doi:10.1097/01.ALC.0000158832.07705.22.
- Todd, M., S. Armeli, H. Tennen, M. A. Carney, S. A. Ball, H. R. Kranzler, and G. Affleck. 2005. Drinking to cope: A comparison of questionnaire and electronic diary reports. *Journal of Studies on Alcohol* 66 (1):121–29. doi:10.15288/jsa.2005.66.121.
- Ullman, S. E., S. M. Townsend, H. H. Filipas, and L. L. Starzynski. 2007. Structural models of the relations of assault severity, social support, avoidance coping, self-blame, and PTSD among sexual assault survivors. *Psychology of Women Quarterly* 31 (1):23–37. doi:10.1111/j.1471-6402.2007.00328.x.
- Wray, T. B., J. E. Merrill, and P. M. Monti. 2014. Using Ecological Momentary Assessment (EMA) to assess situation-level predictors of alcohol use and alcohol-related consequences. *Alcohol Research: Current Reviews* 36 (1):19–27.
- Zatzick, D., G. Jurkovich, P. Heagerty, J. Russo, D. Darnell, L. Parker, M. K. Roberts, R. Moodliar, A. Engstrom, J. Wang, et al. 2021. Stepped collaborative care targeting posttraumatic stress disorder symptoms and comorbidity for US trauma care systems: a randomized clinical trial. *JAMA Surgery* 156 (5):462. doi:10.1001/jamasurg.2021.0131.
- Zatzick, D. F., S. -M. Kang, H. -G. Müller, J. E. Russo, F. P. Rivara, W. Katon, G. J. Jurkovich, and P. Roy-Byrne. 2002. Predicting posttraumatic distress in hospitalized trauma survivors with acute injuries. *The American Journal of Psychiatry* 159 (6):941–46. doi:10.1176/appi.ajp.159.6.941.

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