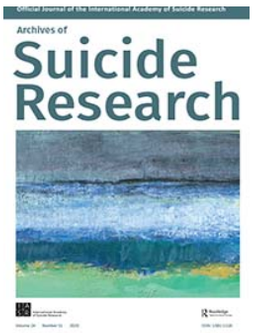

Archives of Suicide Research

ISSN: 1381-1118 (Print) 1543-6136 (Online) Journal homepage: https://www.tandfonline.com/loi/usui20

Does State Dissociation Mediate the Relation Between Alcohol Intoxication and Deliberate Self-Harm?

Matthew A. Timmins, Mitchell E. Berman, Michael R. Nadorff, Suzanne C. Amadi, Jennifer R. Fanning & Michael S. McCloskey

To cite this article: Matthew A. Timmins, Mitchell E. Berman, Michael R. Nadorff, Suzanne C. Amadi, Jennifer R. Fanning & Michael S. McCloskey (2020) Does State Dissociation Mediate the Relation Between Alcohol Intoxication and Deliberate Self-Harm?, Archives of Suicide Research, 24:sup1, 231-242, DOI: 10.1080/13811118.2018.1563577

To link to this article: https://doi.org/10.1080/13811118.2018.1563577

Accepted author version posted online: 13 Jan 2019.
Published online: 11 Mar 2019.

Archives of Suicide Research, 24:S231–S242, 2020

ISSN: 1381-1118 print/1543-6136 online
DOI: 10.1080/13811118.2018.1563577

Routledge
Taylor & Francis Group

Does State Dissociation Mediate the Relation Between Alcohol Intoxication and Deliberate Self-Harm?

Matthew A. Timmins, Mitchell E. Berman, Michael R. Nadorff, Suzanne C. Amadi, Jennifer R. Fanning, and Michael S. McCloskey

Research supports the notion that alcohol intoxication is a risk factor for deliberate self-harm (DSH). However, the underlying mechanisms for this relationship are poorly understood. We aimed to determine whether alcohol-induced dissociation mediated alcohol's effects on DSH. We used data from a dose-response study of alcohol intoxication and DSH to test the proposed model. Participants were assigned to reach target blood alcohol concentrations (BAC) ranging from 0.00% through 0.10% and then completed a behavioral measure of DSH. Dissociation was assessed using the Alcohol Dissociative Experiences Scale. BAC predicted both dissociation and DSH, but dissociation did not predict DSH. Although research on clinical populations suggests dissociation is related to DSH, our findings suggest dissociation does not mediate the effects of alcohol on self-harm.

Keywords alcohol, dissociation, gender, intoxication, self-aggression, self-harm

Deliberate self-harm (DSH) refers to any behavior that results in intentional self-injury across the spectrums of severity and lethality (Muehlenkamp, Claes, Havertape, & Plener, 2012). There are two major divisions within DSH based on the motivation behind the behavior: *non-suicidal self-injury* (NSSI) and *suicide*. NSSI encompasses any form of DSH without the intent to die regardless of the lethality of the behavior (e.g., cutting, burning, head banging), whereas suicide is any DSH behavior accompanied by the intent to die (Crosby, Ortega, & Melanson, 2011; Muehlenkamp et al., 2012). Despite this key difference in lethality, as well as the functions and correlates of those behaviors (e.g., Darke, Campbell, & Popple, 2012; Fliege et al., 2006; Joiner, Ribeiro, & Silva, 2012), both forms of DSH warrant careful study. Indeed, NSSI may facilitate progression towards suicidal behaviors, plausibly by helping to acquire the capability to attempt suicide by reducing the fear of and reactions toward pain and severe harm (Klonsky & May, 2015;

Van Orden et al., 2010). Results of a longitudinal study supporting this progression revealed that college students who reported a history of NSSI were more likely to have attempted suicide at follow-up (Whitlock et al., 2013).

The overall prevalence of DSH far surpasses that of suicide alone. In 2016, the Centers for Disease Control (CDC) identified nearly 45,000 suicides in the United States, making suicide the tenth leading cause of death. In 2015, however, the CDC recorded eleven times as many incidents of NSSI resulting in medical attention compared to suicides in 2016—a rate of 157 per 100,000 in the general population (Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, 2005). These numbers are likely an underestimate, as not all individuals seek medical attention for DSH. Indeed, a study using a random-digit dialing phone survey found that nearly 6% of participants (adults in the United States) endorsed a lifetime history of NSSI (Klonsky, 2011).

One known risk factor for DSH is alcohol use. For example, participants from a non-treatment seeking college sample who endorsed a history of moderate/severe DSH (both NSSI and suicidal behaviors) were more likely to report alcohol misuse (Hasking, Momeni, Swannell, & Chia, 2008). In another study using a large cross-national sample of adolescents, engaging in moderate to heavy drinking behaviors was associated with more severe NSSI behaviors (Rossow et al., 2007). Finally, participants ages 17 to 24 in a large longitudinal study in Australia who endorsed high levels of alcohol use were nearly 24 times more likely to report DSH at baseline and follow-up (Martiniuk et al., 2015). Of note, engaging in high risk taking behaviors was associated with reporting DSH at both times for men but not for women (Martiniuk et al., 2015). Despite supporting an association between alcohol misuse and DSH, a significant limitation of survey studies in general is that they are ill-equipped for testing causal inferences. Additionally, survey studies generally do not disentangle the effects of acute alcohol intoxication from those of chronic alcohol misuse.

Dissociative experiences are also associated with DSH. Indeed, individuals diagnosed with a dissociative disorder are at a six (suicide attempts) to eight (NSSI) time greater risk for DSH as compared to other clinical populations (Calati, Bensassi, & Courtet, 2017). Further, patients with a history of suicide attempts or NSSI reported greater rates of dissociation compared to those without a DSH history (Calati et al., 2017). Dissociation also appears to play a role in DSH in non-clinical populations. Among undergraduates, self-report measures of dissociative experiences were associated with past DSH when controlling for various forms of abuse, neglect, and parent-child experiences (Gratz, Conrad, & Roemer, 2002). In another study of adolescents, dissociative experiences mediated the relationship between reported childhood emotional abuse and frequency of past NSSI (Rallis, Deming, Glenn, & Nock, 2012). These studies support the notion that dissociative experiences may increase the risk of engaging in DSH. Unfortunately, as with many studies on alcohol use, the survey methods used to study dissociation within DSH often do not distinguish between brief and acute dissociative experiences versus trait tendencies toward dissociation.

To remedy the limited causal inferences that can be drawn from cross-sectional survey methods, several experimental studies in humans have

manipulated alcohol dose and prospectively observed DSH using a validated laboratory task (the Self-Aggression Paradigm: SAP, Berman & Walley, 2003; McCloskey & Berman, 2003) providing evidence for a causal relation between alcohol intoxication and DSH (Berman, Bradley, Fanning, & McCloskey, 2009; Berman et al., 2017; McCloskey & Berman, 2003). Moreover, by excluding participants with a history of alcohol dependence, these studies were able to tease apart the effects of acute intoxication from chronic misuse (Berman et al., 2009, 2017; McCloskey & Berman, 2003).

The SAP is a competitive reaction-time completion task against a fictitious opponent that allows the participant to self-select the intensity of a noxious stimulus (i.e., electric shock) to be self-administered on losing trials. Deliberate self-harm (also referred to as self-aggression) is defined by the intensity of shock selected. Self-aggression during the SAP has been associated with scores on self-report measures of suicidal ideation (Berman & Walley, 2003; McCloskey & Berman, 2003) and non-suicidal DSH (McCloskey, Look, Chen, Pajoumand, & Berman, 2012), but it has not been associated with desire to win or reaction-time performance (Berman & Walley, 2003; McCloskey & Berman, 2003). Of course, laboratory tasks cannot, for obvious reasons, assess intent to die. Thus, the SAP is best thought of as a measure of non-lethal DSH.

Using the SAP, three experimental studies with independent samples have been conducted, the results of which support a causal relationship between acute intoxication and non-lethal DSH. For example, in a community sample of non-alcohol dependent men, those who consumed a drink containing enough alcohol to reach a blood-alcohol concentration (BAC) of .10% based on their body weight were more likely to self-select what they were led to believe was an extremely painful shock during the SAP than those who consumed a nonalcoholic placebo drink (McCloskey & Berman, 2003). A second study (Berman et al., 2009) replicated the results of the first study using a veridical drink control rather than a placebo in a sample of non-alcohol dependent men. Additionally, participants' self-awareness was enhanced by seating them in front of a mirror and a video camera so participants were able to see their reflection and a livestream video of themselves as they completed the SAP. The self-awareness manipulation attenuated the effects of alcohol intoxication on DSH in the laboratory, potentially by redirecting attention to self-relevant norms (Berman et al., 2009).

To expand our understanding of acute intoxication's effects on DSH, another more recent SAP study using both men and women was conducted (Berman et al., 2017). In this study, participants were assigned to drink conditions based on target expired BAC—low (.050%), medium (.075%), high (.100%), and placebo (.000%). A dose-dependent relation between alcohol intoxication and DSH was found. Specifically, higher BACs were associated with greater use of a shock representing DSH during the task for all participants. This study provides two advantages over the previous studies: The use of both men and women and the examination of alcohol's effects at multiple doses. Moreover, it appears that "turning up the dial" on intoxication leads to a greater possibility of DSH behavior (Berman et al., 2017).

Although these experimental studies support a causal link between alcohol intoxication and self-harm, the

mechanisms by which acute alcohol intoxication increases the likelihood of engaging in DSH have not yet been examined in the laboratory. Alcohol's ability to cause acute dissociative experiences (e.g., Fillmore & Weafer, 2004) is one likely mechanism. Previous research has shown that risky drinking behaviors are correlated with both dissociative experiences and a desire to dissociate in a sample of college students with a history of binge drinking (Klanecky, McChargue, & Bruggeman, 2012). Additionally, experiencing sexual abuse during childhood and/or adolescence was predictive of problematic drinking, and this relationship was mediated by a desire to dissociate (Klanecky et al., 2012). Another study from the latter research group using undergraduate women found an interaction effect between exposure to childhood sexual abuse and dissociative experiences when predicting alcohol-related blackouts (Klanecky, Harrington, & McChargue, 2008).

The purpose of this study was to determine if experimentally manipulated alcohol intoxication elicits dose-dependent dissociation, and whether these changes in cognition would explain the relationship between acute intoxication and DSH in the laboratory. To this end, we used relevant variables from a dataset on alcohol and DSH described in Berman et al. (2017).

There is evidence that sex differences in alcohol intoxication may also play a role in facilitating DSH. For example, acute intoxication is associated with reduced behavioral inhibition, particularly for men (e.g., Fillmore & Weafer, 2004). Further, women appear to reach peak BAC and eliminate alcohol at a faster rate than men (e.g., Mumenthaler, Taylor, O'Hara, & Yesavage, 1999). Thus, we also conducted an exploratory analysis to determine if any differences between men and women emerged in the proposed mediation model.

METHOD

Participants

Participants ($N = 210$, 104 women and 106 men), ages 21 through 54 ($M = 26$, $SD = 6.96$), self-identified as either Caucasian (65.2%), African-American (24.8%), Hispanic (3.8%), or another ethnicity (6.2%). Participants were excluded if they had never consumed alcohol or met criteria for alcohol dependence during a prescreening telephone interview.

Participants were also excluded if they previously participated in another alcohol- or shock-related study in the same lab; if they had any current medical conditions that were contraindicated for electric shock or alcohol consumption; or if they were unable to follow a week-long protocol prior to a scheduled laboratory session.

All participants were sufficiently proficient in written and spoken English to appropriately follow directions and complete tasks. Additionally, participants were excluded if they demonstrated borderline intellectual functioning or below based on the Wechsler Abbreviated Scale of Intelligence administered during the scheduled session. Approximately 99% of participants were high school graduates or had some level of college experience. At the scheduled session, urine toxicological screening and expired-breath BAC measures were used to exclude participants with a BAC $>$ .000% or those who screened positive for cannabis, opioid, benzodiazepine, methamphetamine, or cocaine. Participants also completed a health

questionnaire. For ethical reasons, participants were excluded if they endorsed receiving treatment for substance use or if they had attempted suicide or engaged in NSSI that required medical attention within the past year. Of the participants included in the current study, nearly 79% reported no history of DSH and just under 97% reported never attempting suicide.

Materials and Procedures

Blood-alcohol Content. BAC was measured at three different points during the study via an expired-breath sample obtained with an Alco-Sensor IV (Intoximeters, Inc., St. Louis, MO) hand-held breathalyzer. As noted above, participants were screened during the day of the study prior to engaging in the laboratory tasks (Time 1).

At the scheduled laboratory session, participants were randomly assigned to one of four drink conditions based on target BAC levels: .000% BAC (placebo), .050% BAC (low), .075% BAC (medium), or .100% BAC (high). Participants in the alcohol groups consumed a mixture of orange juice and 190-proof (95% ethanol) grain alcohol in two cups with a volume of alcohol sufficient to reach the target BAC based on an equation including the participant's weight and gender (Watson, Watson, & Batt, 1981). Those in the placebo condition consumed the equivalent volume of juice as the medium condition with a few drops of alcohol floating on the top of the drink and rubbed around the rim of the cups, but not enough to alter BAC. All participants were informed that the drink might contain alcohol but were given no further information about the drink.

The participant's BAC was measured after a post-consumption 20-minute waiting period (Time 2) prior to beginning the SAP task. The participant's BAC was measured again after completing the SAP task (Time 3). For the current study, the participant's BAC at Time 2 and Time 3 were averaged to give a biological measure of overall intoxication during the SAP task. For greater detail on the alcohol manipulation, see Berman et al. (2017).

Behavioral Analog Measure of DSH. The Self-Aggression Paradigm (SAP: Berman & Walley, 2003; McCloskey & Berman, 2003) was used in the study to measure DSH analog behaviors prospectively under controlled laboratory conditions. As previously described, SAP performance has been associated with self-report measures of DSH, as well as suicidal ideation (Berman & Walley, 2003; McCloskey & Berman, 2003; McCloskey et al., 2012), and behavioral and self-report measures of impulsivity (McCloskey et al., 2012), but is not associated with a desire to win the reaction-time task (Berman & Walley, 2003; McCloskey & Berman, 2003).

After measuring BAC at Time 2, the participant completed the threshold procedure of the SAP, which consisted of administering electrical shocks at increasing levels of current until the participant indicated the shock was "definitely painful." The "definitely painful" shock was recorded as the participant's pain threshold. When self-selecting the shock level on losing trials, the participant chose from no stimulus (0), levels ranging up to the pain threshold (1–10 with 10 being the pain threshold), or an "extreme" level that the participant was told may cause some form of temporary tissue damage or intense pain based upon the stimulus (20) but is actually equivalent to the pain threshold shock. For the purposes of this study, the behavioral measure of DSH was

operationalized as the number of 20 shocks selected.

Dissociative Experiences. After finishing the SAP task, the participant completed the Alcohol Dissociative Experiences Scale (ADES), a modified version of the RAND Peritraumatic Dissociative Experiences Questionnaire (MR-PDEQ: Marshall et al., 2002). When testing the construct validity of the MR-PDEQ, Condon and Lynn (2014) found that scores were strongly correlated with other measures of state dissociation and dissociative experiences, moderately correlated with depressive symptoms, and weakly correlated with state anxiety and affectivity. The MR-PDEQ has demonstrated good internal consistency in samples of undergraduate women in Spain (Gómez-Pérez, López-Martínez, & Asmundson, 2013), Ugandan children and adolescents who were former child soldiers (Klasen et al., 2010), and undergraduates in the United States (Condon & Lynn, 2014), with Cronbach's α ranging from .75 to .87. The ADES is a self-report questionnaire consisting of 8 items related to dissociative states, such as "Things seemed to be happening in slow motion (very slow)" and "What was happening didn't seem real, like I was in a dream or watching a movie." Participants rated each item on a Likert scale from 1 (*not at all true*) to 5 (*extremely true*) with possible total scores ranging from 1 to 40. Higher total scores indicate greater state dissociation experiences during the SAP task. The ADES demonstrated high internal consistency in our sample ($\alpha = .91$).

Data Analyses

Data cleaning and statistical analyses were conducted using IBM SPSS, version 24 (IBM Corp., 2016). A moderated-mediation regression analysis was conducted using Model 59 of the PROCESS macro (Hayes, 2013) for SPSS. Specifically, number of "20" shocks were regressed on BAC with ADES scores entered a mediator variable. By using Model 59, sex was used to moderate the direct effect, as well as both path a and path b indirect effects. For ease of interpreting the model, all BAC and ADES scores were mean centered prior to conducting the analysis.

RESULTS

The average BAC recorded during the task ranged between .00% to .15% ($M = .06$, $SD = .04$). The number of "20" shocks selected ranged from 0 to 20 ($M = 2.86$, $SD = 5.80$). The ADES scores ranged from 7 to 36 ($M = 10.76$, $SD = 5.25$). Number of "20" shocks selected were positively skewed; thus, a logarithmic transformation was performed.

Moderated Mediation Analysis

The overall model was significant, $F(5, 204) = 11.32$, $p < .001$ ($R = .45$; $R^2 = .20$; MSE = 0.17). BAC predicted both ADES scores, $t(206) = 3.78$ ($b = 37.10$, $SE = 9.82$; 95% CI [17.74, 56.47]) and number of "20" shocks selected $t(204) = 4.07$ ($b = 2.83$, $SE = 0.70$; 95% CI [1.46, 4.20]). However, ADES scores did not predict DSH (95% CI [−0.02, 0.02]). Thus, although the overall model was significant, ADES scores did not mediate the relationship between BAC and DSH, and our first prediction was not supported.

When examining participant sex as a moderator in the analysis, a main effect was found ($b = -1.91$, $SE = 0.68$,

$t(206) = -2.80$, 95% CI [−3.25, −0.56]) such that women endorsed more state dissociation while intoxicated. No interaction effect was found between participant sex and BAC when predicting ADES (95% CI [−75.70, 1.72]). Participant sex showed main ($b = 0.32$, $SE = 0.06$, $t(204) = 5.14$, 95% CI [0.20, 0.45]) and interaction ($b = 3.47$, $SE = 1.38$, $t(206) = 2.51$, 95% CI [0.74, 6.20]) effects with BAC when predicting DSH such that men engaged in more DSH and were more affected by intoxication. Participant sex did not interact with ADES when predicting DSH (95% CI [−0.05, 0.03]). See Table 1 for outcomes of all variables in the regression.

DISCUSSION

Despite the fact that alcohol-related dissociation experiences did not mediate the relation between acute alcohol intoxication and DSH, the results of our model still provide important information. To begin, our results suggest that there may be a dose dependent relationship between alcohol consumption and dissociation-like experiences. In addition, it appears that women were more likely to experience state dissociation during the task than men regardless of BAC.

It is worthwhile to consider why alcohol-related dissociation was not associated with DSH as assessed by the SAP. Our analysis examined state dissociation in the presence of alcohol; however, prior research on state dissociation and DSH often examined this relationship in the presence of traumatic experiences rather than acute alcohol intoxication (e.g., Briere & Eadie, 2016; Rallis et al., 2012). It is plausible that the association between dissociation and DSH may stem from repetitive dissociative experiences,

TABLE 1. **Moderated Mediation Analysis - Gender Moderating the Relationship between Average BAC and Total 20s**

		Outcomes									
		ADES					Total 20s				
		b_i	*SE*	*t*	95% CI		b_i	*SE*	*t*	95% CI	
BAC	*a*	37.10	9.82	3.78	[17.74, 56.47]	*c'*	2.83	0.70	4.07	[1.46, 4.20]	
Sex	*d*	−1.91	0.68	−2.80	[−3.25, −0.56]	*d*	0.32	0.06	5.14	[0.20, 0.45]	
BAC × Sex	*ad*	−36.99	19.63	−1.88	[−75.70, 1.72]	*dc'*	3.47	1.38	2.51	[0.74, 6.20]	
ADES		-	-	-	-	*b*	0.003	0.01	0.35	[−0.02, 0.02]	
Sex × ADES		-	-	-	-	*bd*	−0.01	0.06	−0.40	[−0.05, 0.03]	
Constant	i_1	−0.02	0.34	−0.06	[−0.69, 0.65]	i_2	0.27	0.03	8.51	[0.21, 0.33]	
		$R^2 = .13$, $MSE = 23.97$, $F(3, 206) = 6.66$, $p < .001$					$R^2 = .20$, $MSE = 0.17$, $F(5, 204) = 11.32$, $p < .001$				

flashbacks to traumatic events, or other elements not captured by the ADES, rather than alcohol-induced state dissociation.

Related to the measurement of dissociative experiences, alcohol-induced and psychogenic dissociation may represent different structures of dissociation. Alcohol appears to block the formation and recall of new memories (e.g., Curran & Hildebrandt, 1999) and produces an antinociceptive analgesic effect (e.g., Campbell, Taylor, & Tizabi, 2006), which combined may form dissociative experiences resulting from intoxication. In contrast, derealization, depersonalization, "flashbacks," and other symptoms related to psychogenic dissociative experiences, such as in posttraumatic stress disorder (American Psychiatric Association, 2013), may represent a distinct and separate form of dissociation than alcohol-induced dissociation. These different structures may explain why research using clinical populations has found an association between dissociation and DSH, (e.g., Gratz et al., 2002; Rallis et al., 2012), whereas the current study did not.

Another aspect to consider is the function of DSH. Research specifically on nonfatal DSH points to emotion regulation as a function of NSSI (e.g., Hasking & Rose, 2016; Klonsky & Glenn, 2009; Klonsky et al., 2015; Nock & Prinstein, 2004). Such research implies that NSSI may be used to escape unwanted dissociative experiences, particularly for clinical populations who repetitively engage in NSSI. Given the relatively limited history of DSH in our sample, participants may have not developed NSSI as an escape behavior. Future research may use participants with a detailed history of NSSI and dissociation to compare to state dissociation and DHS under controlled laboratory conditions.

Our exploratory analyses using sex as a moderator found main and interaction effects on the direct pathway between BAC and DSH. Specifically, the relation between BAC and DSH was stronger for men, who also engaged in more DSH overall. With regards to the sex differences in intoxication predicting DSH, acute intoxication may affect men and women differently in a variety of areas. For example, in one study, men had a significantly greater reduction in glucose metabolism after moderate alcohol consumption, particularly in the frontal cortex, than women (Wang et al., 2003). Similarly, men demonstrated greater impaired behavioral inhibition on a cued go/no-go when moderately intoxicated compared to women (Fillmore & Weafer, 2004). In this same vein, sex differences in executive functioning when intoxicated appear to mirror research examining the effects of alcohol intoxication on impulsive behavior such as aggression. In two separate studies utilizing relatively large sample sizes, both men and women who were highly intoxicated (1.00 g/kg of a 95% alcohol drink to body mass) engaged in more behavioral aggression, assessed using laboratory paradigms, than their sober counterparts (Giancola et al., 2009; Giancola & Parrott, 2008). Additionally, significant interactions between gender and intoxication emerged in both studies such that intoxicated men displayed more aggression than intoxicated women. Taken together, men appear to have larger executive functioning deficits and are more willing to engage in dangerous behaviors when intoxicated as compared to women despite our finding that women endorsed more dissociation while intoxicated.

Some researchers have argued that impulse control and sensation seeking behaviors follow different developmental

pathways in male versus female adolescents and young adults (Shulman, Harden, Chein, & Steinberg, 2015). Shulman et al. (2015) propose that that adolescent and young adult men are more impulsive and sensation seeking than women; however, these gender differences tend to disappear later in adulthood. Noting the relatively young age of the sample used in the current analysis with an average age of 26, the impact of alcohol on executive functioning could be more pronounced in this sample than it would be in an older sample.

The current study has several strengths. We used a behavioral measure of DSH under controlled laboratory conditions, which allowed for prospective observation of DSH and experimental manipulations of acute alcohol intoxication. By including a measure of dissociative experiences, we were also able to examine chemically induced state dissociation while engaging in DSH. The use of both men and women within a sample is another strength as there are no other published studies using the current paradigm to examine sex differences and intoxication. Another strength was measuring breath expired BAC as a more precise primary measure of intoxication than drink condition based on one target BAC, as used in some SAP studies (e.g., McCloskey & Berman, 2003).

There were also some limitations, including restrictions on the highest shock and highest target BAC, which, though necessary for participant safety, may limit generalizability. Similarly, clinical populations, including problematic drinkers and psychiatric patients, as well as nondrinkers, were excluded from the sample so the results cannot be generalized beyond a generally healthy and young community sample. Indeed, it is possible that the relationship between intoxication and DSH might be more pronounced in a population with more significant DSH or alcohol use (e.g., Bresin & Schoenleber, 2015). In fact, relationships have been found between seeking treatment for alcohol abuse and NSSI (Darke et al., 2012), heavy alcohol use and repetitive NSSI (Martiniuk et al., 2015), and moderate to heavy adolescent alcohol use and DSH within the past year (Rossow et al., 2007). Even though roughly 21% of participants in our study endorsed some form of DSH, including 10% endorsing at least one suicide attempt in their lifetime, this study does not give adequate insight into individuals who frequently engage in DSH, nor those who experience dissociation absent intoxication. It is plausible that a similar study of a sample with frequent DSH might find a greater relationship between BAC and DSH. Thus, as frequent dissociation has been associated with frequent suicidal and non-suicidal DSH (e.g., Calati et al., 2017), it is likely that the path between alcohol-related state dissociation and DSH would be significant in a clinical sample. Despite these limitations, the results of the study support a direct and dose-dependent relationship between alcohol intoxication and acute dissociative experiences. As there are various ways to safely induce pain within the laboratory and multiple paradigms for behaviorally measuring DSH, each with its own unique advantages and disadvantages (e.g., Ammerman, Berman, & McCloskey, 2018), future research may repeat our study using a multimodal approach.

AUTHOR NOTE

Matthew A. Timmins, Department of Psychology, Mississippi State University, Starkville, MS, USA.

Mitchell E. Berman, Department of Psychology, Mississippi State University, Starkville, MS, USA.

Michael R. Nadorff, Department of Psychology, Mississippi State University, Starkville, MS, USA.

Suzanne C. Amadi, Department of Psychology, Mississippi State University, Starkville, MS, USA.

Jennifer R. Fanning, Department of Psychiatry and Behavioral Neuroscience, The University of Chicago, Chicago, IL, USA; McLean Hospital, Center for Depression, Anxiety and Stress Research, Harvard Medical School, Belmont, MA, USA.

Michael S. McCloskey, Department of Psychology, Temple University, Philadelphia, PA, USA.

Correspondence concerning this article should be addressed to Matthew A. Timmins, Department of Psychology, Mississippi State University, Mississippi State, MS 39762, USA. E-mail: mat306@msstate.edu

FUNDING

This research was supported in part by a grant from the National Institute on Alcohol Abuse and Alcoholism (AA014025).

REFERENCES

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5TM* (5th ed.). Arlington, VA, US: American Psychiatric Publishing, Inc.

Ammerman, B. A., Berman, M. E., & McCloskey, M. S. (2018). Assessing non-suicidal self-injury in the laboratory. *Archives of Suicide Research*, *22*(2), 193–223. doi:10.1080/13811118.2017.1319312

Berman, M. E., Bradley, T. P., Fanning, J. R., & McCloskey, M. S. (2009). Self-focused attention reduces self-injurious behavior in alcohol-intoxicated men. *Substance Use & Misuse*, *44*(9–10), 1280–1297. doi:10.1080/10826080902961328

Berman, M. E., Fanning, J. R., Guillot, C. R., Marsic, A., Bullock, J., Nadorff, M. R., & McCloskey, M. S. (2017). Effects of alcohol dose on deliberate self-harm in men and women. *Journal of Consulting and Clinical Psychology*, *85*(9), 854–861. doi:10.1037/ccp0000222

Berman, M. E., & Walley, C. J. (2003). Imitation of self-aggressive behavior: An experimental test of the contagion hypothesis. *Journal of Applied Social Psychology*, *33*(5), 1036–1057. doi:10.1111/j.1559-1816.2003.tb01937.x

Bresin, K., & Schoenleber, M. (2015). Gender differences in the prevalence of nonsuicidal self-injury: A meta-analysis. *Clinical Psychology Review*, *38*(Supplement C), 55–64. doi:10.1016/j.cpr.2015.02.009

Briere, J., & Eadie, E. M. (2016). Compensatory self-injury: Posttraumatic stress, depression, and the role of dissociation. *Psychological Trauma: Theory, Research, Practice, and Policy*, *8*(5), 618–625. doi:10.1037/tra0000139

Calati, R., Bensassi, I., & Courtet, P. (2017). The link between dissociation and both suicide attempts and non-suicidal self-injury: Meta-analyses. *Psychiatry Research*, *251*, 103–114. doi:10.1016/j.psychres.2017.01.035

Campbell, V. C., Taylor, R. E., & Tizabi, Y. (2006). Antinociceptive effects of alcohol and nicotine: Involvement of the opioid system. *Brain Research*, *1097*(1), 71–77. doi:10.1016/j.brainres.2006.04.054

Centers for Disease Control and Prevention, National Center for Injury Prevention and Control. (2005). *Web-based Injury Statistics Query and Reporting System (WISQARS).* Retrieved from www.cdc.gov/injury/wisqars

Condon, L. P., & Lynn, S. J. (2014). State and trait dissociation: Evaluating convergent and discriminant validity. *Imagination, Cognition and Personality*, *34*(1), 25–37. doi:10.2190/IC.34.1.c

Crosby, A. E., Ortega, L., & Melanson, C. (2011). *Self-directed violence surveillance [electronic resource]: uniform definitions and recommended data elements/ Alex E. Crosby, LaVonne Ortega, Cindi Melanson.* Atlanta, Ga.: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, Division of Violence Prevention, [2011]. Retrieved from https://login.proxy.library.

msstate.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=edsgpr&AN=gprocn794443149&site=eds-live

Curran, H. V., & Hildebrandt, M. (1999). Dissociative effects of alcohol on recollective experience. *Consciousness and Cognition*, *8*(4), 497–509. doi:10.1006/ccog.1999.0417

Darke, S., Campbell, G., & Popple, G. (2012). Self-harm and attempted suicide among therapeutic community admissions: Suicide and self-harm. *Drug and Alcohol Review*, *31*(4), 523–528. doi:10.1111/j.1465-3362.2011.00344.x

Fillmore, M. T., & Weafer, J. (2004). Alcohol impairment of behavior in men and women. *Addiction (Abingdon, England)*, *99*(10), 1237–1246. doi:10.1111/j.1360-0443.2004.00805.x

Fliege, H., Kocalevent, R.-D., Walter, O. B., Beck, S., Gratz, K. L., Gutierrez, P. M., & Klapp, B. F. (2006). Three assessment tools for deliberate self-harm and suicide behavior: Evaluation and psychopathological correlates. *Journal of Psychosomatic Research*, *61*(1), 113–121. doi:10.1016/j.jpsychores.2005.10.006

Giancola, P. R., Levinson, C. A., Corman, M. D., Godlaski, A. J., Morris, D. H., Phillips, J. P., & Holt, J. C. D. (2009). Men and women, alcohol and aggression. *Experimental and Clinical Psychopharmacology*, *17*(3), 154–164. doi:10.1037/a0016385

Giancola, P. R., & Parrott, D. J. (2008). Further evidence for the validity of the Taylor Aggression Paradigm. *Aggressive Behavior*, *34*(2), 214–229. doi:10.1002/ab.20235

Gómez-Pérez, L., López-Martínez, A. E., & Asmundson, G. J. G. (2013). Predictors of trait dissociation and peritraumatic dissociation induced via cold pressor. *Psychiatry Research*, *210*(1), 274–280. doi:10.1016/j.psychres.2013.06.001

Gratz, K. L., Conrad, S. D., & Roemer, L. (2002). Risk factors for deliberate self-harm among college students. *American Journal of Orthopsychiatry*, *72*(1), 128–140. doi:10.1037/0002-9432.72.1.128

Hasking, P., Momeni, R., Swannell, S., & Chia, S. (2008). The nature and extent of non-suicidal self-injury in a non-clinical sample of young adults. *Archives of Suicide Research*, *12*(3), 208–218. doi:10.1080/13811110802100957

Hasking, P., & Rose, A. (2016). A preliminary application of social cognitive theory to nonsuicidal self-injury. *Journal of Youth and Adolescence*, *45*(8), 1560–1574. doi:10.1007/s10964-016-0449-7

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY, US: Guilford Press. Retrieved from https://login.proxy.library.msstate.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2013-21121-000&site=eds-live

IBM Corp. (2016). *IBM SPSS Statistics for Windows*, Version 24.0. Armonk, NY: IBM Corp.

Joiner, T. E., Ribeiro, J. D., & Silva, C. (2012). Nonsuicidal self-injury, suicidal behavior, and their co-occurrence as viewed through the lens of the interpersonal theory of suicide. *Current Directions in Psychological Science*, *21*(5), 342–347. doi:10.1177/0963721412454873

Klanecky, A. K., Harrington, J., & McChargue, D. E. (2008). Child sexual abuse, dissociation, and alcohol: Implications of chemical dissociation via blackouts among college women. *The American Journal of Drug and Alcohol Abuse*, *34*(3), 277–284. doi:10.1080/00952990802013441

Klanecky, A., McChargue, D. E., & Bruggeman, L. (2012). Desire to dissociate: Implications for problematic drinking in college students with childhood or adolescent sexual abuse exposure. *The American Journal on Addictions*, *21*(3), 250–256. doi:10.1111/j.1521-0391.2012.00228.x

Klasen, F., Oettingen, G., Daniels, J., Post, M., Hoyer, C., & Adam, H. (2010). Posttraumatic resilience in former Ugandan child soldiers. *Child Development*, *81*(4), 1096–1113. doi:10.1111/j.1467-8624.2010.01456.x

Klonsky, E. D. (2011). Non-suicidal self injury in United States adults: Prevalence, sociodemographics, topography and functions. *Psychological Medicine*, *41*(09), 1981–1986. doi:10.1017/S0033291710002497

Klonsky, E. D., & Glenn, C. R. (2009). Assessing the functions of non-suicidal self-injury: Psychometric properties of the Inventory of Statements About Self-injury (ISAS). *Journal of Psychopathology and Behavioral Assessment*, *31*(3), 215–219. doi:10.1007/s10862-008-9107-z

Klonsky, E. D., Glenn, C. R., Styer, D. M., Olino, T. M., & Washburn, J. J. (2015). The functions of nonsuicidal self-injury: Converging evidence for a two-factor structure. *Child & Adolescent Psychiatry & Mental Health*, *9*(1), 44. doi: 10.1186/s13034-015-0073-4

Klonsky, E. D., & May, A. M. (2015). The Three-Step Theory (3ST): A new theory of suicide rooted in the "ideation-to-action" framework. *International Journal of Cognitive Therapy*, *8*(2), 114–129. doi:10.1521/ijct.2015.8.2.114

Marshall, G. N., Orlando, M., Jaycox, L. H., Foy, D. W., & Belzberg, H. (2002). Development and validation of a modified version of the Peritraumatic Dissociative Experiences Questionnaire. *Psychological Assessment*, *14*(2), 123–134. doi:10.1037/1040-3590.14.2.123

Martiniuk, A. L. C., Chen, H.-Y., Glozier, N., Patton, G., Senserrick, T., Williamson, A., … Ivers, R. (2015). High alcohol use a strong and significant risk factor for repetitive self-harm in female and male youth: A prospective cohort study. *The American Journal of Drug and Alcohol Abuse*, *41*(5), 465–473. doi:10.3109/00952990.2015.1062023

McCloskey, M. S., & Berman, M. E. (2003). Alcohol intoxication and self-aggressive behavior. *Journal of Abnormal Psychology*, *112*(2), 306–311. doi:10.1037/0021-843X.112.2.306

McCloskey, M. S., Look, A. E., Chen, E. Y., Pajoumand, G., & Berman, M. E. (2012). Nonsuicidal self-injury: Relationship to behavioral and self-rating measures of impulsivity and self-aggression. *Suicide and Life-Threatening Behavior*, *42*(2), 197–209. doi:10.1111/j.1943-278X.2012.00082.x

Muehlenkamp, J. J., Claes, L., Havertape, L., & Plener, P. L. (2012). International prevalence of adolescent non-suicidal self-injury and deliberate self-harm. *Child and Adolescent Psychiatry and Mental Health*, *6*(1), 10. doi:10.1186/1753-2000-6-10

Mumenthaler, M. S., Taylor, J. L., O'Hara, R., & Yesavage, J. A. (1999). Gender differences in moderate drinking effects. *Alcohol Research & Health*, *23*(1), 55–64.

Nock, M. K., & Prinstein, M. J. (2004). A functional approach to the assessment of self-mutilative behavior. *Journal of Consulting and Clinical Psychology*, *72*(5), 885–890. doi: 10.1037/0022-006X.72.5.885

Rallis, B. A., Deming, C. A., Glenn, J. J., & Nock, M. K. (2012). What is the role of dissociation and emptiness in the occurrence of nonsuicidal self-injury? *Journal of Cognitive Psychotherapy*, *26*(4), 297–298. doi:10.1891/0889-8391.26.4.287

Rossow, I., Ystgaard, M., Hawton, K., Madge, N., van Heeringen, K., de Wilde, E. J., … Morey, C. (2007). Cross-national comparisons of the association between alcohol consumption and deliberate self-harm in adolescents. *Suicide and Life-Threatening Behavior*, *37*(6), 605–615. doi: 10.1521/suli.2007.37.6.605

Shulman, E. P., Harden, K. P., Chein, J. M., & Steinberg, L. (2015). Sex differences in the developmental trajectories of impulse control and sensation-seeking from early adolescence to early adulthood. *Journal of Youth and Adolescence*, *44*(1), 1–17. doi:10.1007/s10964-014-0116-9

Van Orden, K. A., Witte, T. K., Cukrowicz, K. C., Braithwaite, S. R., Selby, E. A., & Joiner, T. E. (2010). The interpersonal theory of suicide. *Psychological Review*, *117*(2), 575–600. doi: 10.1037/a0018697

Wang, G.-J., Volkow, N. D., Fowler, J. S., Franceschi, D., Wong, C. T., Pappas, N. R., … Ma, Y. (2003). Alcohol intoxication induces greater reductions in brain metabolism in male than in female subjects. *Alcoholism: Clinical and Experimental Research*, *27*(6), 909–917. doi: 10.1111/j.1530-0277.2003.tb04415.x

Watson, P. E., Watson, I. D., & Batt, R. D. (1981). Prediction of blood alcohol concentrations in human subjects. Updating the Widmark Equation. *Journal of Studies on Alcohol*, *42*(7), 547–556. doi:10.15288/jsa.1981.42.547

Whitlock, J., Muehlenkamp, J., Eckenrode, J., Purington, A., Baral Abrams, G., Barreira, P., & Kress, V. (2013). Nonsuicidal self-injury as a gateway to suicide in young adults. *Journal of Adolescent Health*, *52*(4), 486–492. doi:10.1016/j.jadohealth.2012.09.010