Association of Gender, Race, Mechanism of Injury on Alcohol Use, Posttraumatic Stress Disorder, and Depression in Trauma



Colleen M. Trevino, PhD, NP^(D) = Ryan C. Shorey, PhD^(D) = Carisa Bergner, MA^(D) = Amber Brandolino, MS^(D) = Terri deRoon-Cassini, PhD^(D) = Christopher R. France, PhD^(D)

BACKGROUND:	There is a paucity of literature documenting whether trauma patients with different mechanisms of injury have dif- ferent rates of hazardous alcohol use and/or risk for depression and posttraumatic stress disorder.
OBJECTIVE:	The purpose of this article is to determine whether there are associations between mechanism of injury, hazardous drinking, depression, and posttraumatic stress disorder. Secondary objectives were to examine associations prior to and after the onset of the COVID-19 pandemic.
METHODS:	This is a retrospective cohort study of 5 years of trauma registry data of adult trauma patients (older than 18 years) admitted to a Midwestern Level I trauma center conducted from January 2016 to November 2020. Multivariable logistic regression analyses were performed to explore the association of gender, race, and mechanism of injury on hazardous drinking and posttraumatic stress disorder and depression.
RESULTS:	A total of 9,392 trauma patients completed the Alcohol Use Disorders Identification Test—Consumption Items to identify hazardous drinking, and 5,012 completed the Injured Trauma Survivor Screen to identify risk for developing posttraumatic stress disorder and/or depression. The proportion of patients screening positive for hazardous drinking was higher for motor vehicle collisions (21.9%) than for gunshot wounds (17.6%) or falls (18.8%; $\chi^2(2) = 14.311$, $p < .001$). Those involved in motor vehicle collisions were also at a higher risk for the development of depression and posttraumatic stress disorder (54.5%) relative to falls (33.5%) but not gunshot wounds (50.7%; $\chi^2(2) = 200.185$, $p < .001$). The impact of COVID-19 revealed increased hazardous drinking, depression, and posttraumatic stress disorder in patients with falls and motor vehicle collisions but not gunshot wounds.
CONCLUSIONS:	Motor vehicle collision patients are at most risk for hazardous drinking concomitant with risk for depression and posttraumatic stress disorder. These results help focus future research efforts toward interventions that can reduce these risks.
KEY WORDS:	Alcohol use disorder, Alcohol Use Disorders Identification Test, AUDIT-C, COVID-19, Depression, Injured Trauma Survivor Screen, ITSS, Mechanism of injury, Posttraumatic stress disorder, Trauma Cite as: Trevino, C.M., Shorey, R.C., Bergner, C., Brandolino, A., deRoon-Cassini, T., & France, C.R. (2022). Association of gender, race, mechanism of injury on alcohol use, posttraumatic stress disorder, and depression in trauma. <i>Journal of Trauma Nursing, 29</i> (5), 228-234. https://doi.org/10.1097/

Screening, brief intervention, and referral for alcohol use disorder (AUD) have been required for Level I and Level II trauma centers since 2007 (American College of Surgeons Committee on Trauma, 2006). This action

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Author Affiliations: Department of Surgery, Division of Trauma and Acute Care Surgery (Drs Trevino and deRoon-Cassini and Ms Brandolino) and Comprehensive Injury Center (Ms Bergner), Medical College of Wisconsin, Milwaukee; Department of Psychology, University of Wisconsin-Milwaukee, Milwaukee (Dr Shorey); and Department of Psychology, Ohio University, Athens (Dr France).

Colleen M. Trevino and Carisa Bergner had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

The authors declare no conflicts of interest.

Correspondence: Colleen M. Trevino, PhD, NP, Department of Surgery, Division of Trauma and Acute Care Surgery, Medical College of Wisconsin, 8701 Watertown Plank Rd, Milwaukee, WI 53226 (ctrevino@mcw.edu).

was brought about because of the high documented lifetime diagnosis of AUD (54.2%) in trauma patients (Soderstrom et al., 1997) and the demonstrated efficacy of a brief intervention during hospitalization at reducing alcohol intake over 1-year postinjury (Gentilello et al., 1999). Our institution has been consistent with the directive since 2007 in administering the Alcohol Use Disorders Identification Test—Consumption Items (AUDIT-C; Bush et al., 1998) to screen for hazardous alcohol use among hospitalized trauma patients and then providing a brief intervention for those who screen positive for hazardous drinking (Bruguera et al., 2018).

Although not a focus of the directive, since 2014, our institution has also screened hospitalized trauma patients for symptoms of depression and posttraumatic stress disorder (PTSD), as these conditions are known to be elevated following traumatic injury (Zatzick et al., 2003) and are frequently comorbid with AUD (Zatzick et al., 2004). The

KEY POINTS

- Thirty percent of MVCs screened positive for at-risk drinking, higher than GSW or fall patients.
- MVC patients were at highest risk for co-occurrence of at-risk alcohol use, depression, and PTSD.
- Fall patients were highest for at-risk drinking during the COVID-19 pandemic.

prevalence of comorbid depression and PTSD after traumatic injury has been documented to be as high as 31% for each disorder, with depression and PTSD co-occurring in 21% of survivors (Shih et al., 2010). Prevalence studies show that up to half of all patients with alcohol misuse have PTSD (Debell et al., 2014), and 42% of those with PTSD also report substance abuse (Pietrzak et al., 2011). It has been proposed that the observed co-occurrence of alcohol misuse and PTSD may arise from individual efforts to self-medicate symptoms among those with PTSD or an increased risk of trauma among those who misuse substances (Pietrzak et al., 2011). In the context of COVID-19, the risk for higher incidences of hazardous drinking, depression, and PTSD has been reported (Eastman et al., 2021; Ettman et al., 2020; Shevlin et al., 2020).

There is a paucity of literature documenting the impact of mechanism of injury (MOI) on hazardous alcohol use, depression, and PTSD. Two single-site studies suggest that assaultive trauma is associated with higher alcohol and substance abuse (Ramchand et al., 2009; Soderstrom et al., 1997). However, whether specific MOIs may be associated with more hazardous drinking, depression, and PTSD is unknown.

OBJECTIVE

The purpose of this article is to determine whether there are associations between MOI and hazardous drinking, depression, and PTSD. Secondary objectives were to examine associations prior to and after the onset of the COVID-19.

METHODS

This is a retrospective cohort study of 5 years of trauma registry data of patients older than 18 years admitted to a Midwestern Level I trauma center conducted from January 2016 to November 2020. Our local trauma registry includes screening scores for alcohol use, depression, and PTSD. The Medical College of Wisconsin Institutional Review Board exempted this study as a quality project (PRO00041765). All patients admitted to the trauma program were included, and those who had AUDIT-C and Injured Trauma Survivor Screen (ITSS) screening were kept for inclusion in the analysis (Table 1). Those with missing AUDIT-C and ITSS data were excluded.

Screening Tools

Alcohol Use Disorders Identification Test—Consumption Items

The AUDIT-C is a validated brief alcohol-screening instrument that identifies people who are hazardous drinkers or who may have an active AUD (Stewart et al., 2021). The AUDIT-C has three questions, and total scores can range from 0 to 12. Each AUDIT-C question has five answer choices ranging from 0 points to 4 points. A score of 4 or more is considered positive for hazardous drinking in men, and 3 or more is considered positive in women (Bush et al., 1998, Soderstrom et al., 1997). The higher the score, the more likely a person's drinking affects their safety (Bush et al., 1998). In this study, the patients were identified as hazardous drinkers or at risk for AUD if their AUDIT-C scores were 4 and greater for men or 3 and greater for women (Bush et al., 1998).

Table 1. P	articipan	it Demo	graphic	s on the and l	e Alcoho njured T	l Use D rauma	isorders Survivoi	ldentifi Screen	cation 7 (ITSS)	¯est—Co	onsump	tion Iten	ns (AUI	DIT-C)
	AUDIT-C							ITSS						
	Total N = 9,392		Yes <i>N</i> = 1,835		No <i>N</i> = 7,557		-	Total <i>N</i> = 5,012		Yes <i>N</i> = 2,096		No <i>N</i> = 2,916		-
	п	%	п	%	п	%	р	n	%	п	%	п	%	р
MOI														
Fall	5,474	58.3	1,029	56.1	4,445	58.8		2,899	57.8	970	46.3	1,929	66.2	
GSW	1,184	12.6	208	11.3	976	12.9		678	13.5	344	16.4	334	11.5	
MVC	2,734	29.1	598	32.6	2,136	28.3		1,435	28.6	782	37.3	653	22.4	
Gender							<.01							<.01
Female	4,133	44.0	635	34.6	3,498	46.3		2,106	42.0	835	39.8	1,271	43.6	
Male	5,259	56.0	1,200	65.4	4,059	53.7		2,906	58.0	1,261	60.2	1,645	56.4	
Age, M(SD)	56.6 (24.0) 50.1 (19.2		(19.2)	58.2 (24.8)		<.01	56.5 (23.8)		52.0 (22.7)		59.7 (24.0)		<.01	
Note ALIDIT-C =	Alcohol I Ise Di	sorders Iden	tification Test	Consumn	tion Items: GS	W = aunsh	ot wound: ITS	S = Injured -	Trauma Surv	ivor Screen: N	IOI = mech	anism of inium	r MVC = m	notor

Note. AUDIT-C = Alcohol Use Disorders Identification Test—Consumption Items; GSW = gunshot wound; ITSS = Injured Trauma Survivor Screen; MOI = mechanism of injury; MVC = motor vehicle collision.

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Figure 1. Flow diagram of included and excluded patients. AUDIT-C = Alcohol Use Disorders Identification Test— Consumption Items; ITSS = Injured Trauma Survivor Screen.

Injured Trauma Survivor Screen

The ITSS is a validated 9-item screening tool used to identify the risk for developing PTSD and depression in individuals who have experienced a traumatic injury. Five items contribute to risk assessment for PTSD and five for depression, with one overlapping item. Items use a yes or no response format to assess pre-, peri-, and posttraumatic risk factors (Hunt et al., 2017). A score of 2 and more for PTSD and Depression indicated risk separately for the disorders. Those who screened at risk for one or both separately were considered at risk for PTSD or depression. In this study, the risk for the development of depression and/ or PTSD was determined by ITSS scores of 2 and greater in either domain (Hunt et al., 2018, Hunt et al., 2021).

Statistical Approach

Descriptive statistics were used to describe baseline characteristics. Categorical variables were presented as counts and percentages. Chi-square tests and analysis of variance were used to compare categorical variables of interest. Data prior to March 1, 2020, were considered *before* COVID-19. Logistic regression models were constructed to assess the potential moderating effects of gender, race, and MOI on AUDIT-C and ITSS scores. Subgroup analyses were conducted to examine potential changes in these associations before and after the onset of the COVID-19. Data analysis was performed using R version 1.2 (R Foundation for Statistical Computing, Vienna, Austria). Statistical significance was determined by a p < .05.

RESULTS

Demographic, Injury, and Screening Characteristics

A total of 10,391 trauma patients were admitted during the study period. The mean age was 55.7 years (SD = 24.0); most were male (57.5%), White 65.8%, or Black 30.7%. The most common MOI was fall (56.3%), followed by motor vehicle collision (MVC; 29.2%) and gunshot wound (GSW; 14.5%). A total of 9,392 patients were screened with the AUDIT-C, and 5,012 patients were screened with the ITSS (Figure 1). Because there was no mandate to screen for depression or PTSD, there was a reduced completion rate for the ITSS compared with the AUDIT-C. Subjects with missing AUDIT-C scores (9.6%) or ITSS scores (5.18%) were excluded.

Overall, 19.5% (n = 1,835/9,392) of the sample met the cutoff score on the AUDIT-C for hazardous drinking or risk for AUD and 41.8% (n = 2,096/5,012) met the cutoff score for risk for depression or PTSD on the ITSS. Demographic comparisons revealed that those who scored at risk on the AUDIT-C were significantly younger (M = 50.1, SD = 19.2) than those who were below the cut score (M = 58.2, SD = 24.8; p < .001). Similarly, those scoring in the risk range on the ITSS were significantly younger than those below the cut score (M = 52.0,SD = 22.7 and M = 59.7, SD = 24.0, respectively; p <.001). Out of those who screened at risk, men were more likely than women to score at risk on both the AUDIT-C (male = 65.4%, female = 34.6%; p < .001) and the ITSS (male = 60.2%, female = 39.8%; p = .008).

The proportions of positive AUDIT-C screens were examined as a function of MOI. As shown in Table 2, a larger proportion of MVC patients were at risk for hazardous drinking or AUD compared with fall or GSW patients. A higher proportion of MVC patients were also identified as at risk for depression and/or PTSD relative to fall patients, but MVC patients did not differ from GSW patients as at risk for depression and/ or PTSD. Finally, a higher proportion of MVC patients were considered at risk on both the AUDIT-C and the ITSS relative to fall patients but not as compared with GSW patients.

Relationship of MOI, Gender, and Race With Screening Outcomes

Multivariable logistic regressions were conducted with AUDIT-C or ITSS as the dependent variables, where a positive screening yielded a value of 1 (with "0," negative screening, as the reference group). In separate models, gender and race (White vs. non-White) were dichotomized and considered in interaction with MOI to assess their potential moderating effects on AUDIT-C and ITSS scores. Figure 2 illustrates the results of these analyses, and in each model, the reference category was White females who sustained an injury from a fall. Because the gender, race, and MOI were reported as proportions, predicted probabilities were used to report the logistic regression results. Missing data were excluded listwise, reducing the sample that was analyzed, which may not have been random, introducing bias. Interpretation of the models shows significant differences when there is no overlap in the variables on the predicted probability scale.

 Table 2. Proportion of High-Risk Scores on the Alcohol Use Disorders Identification Test—Consumption Screening (AUDIT-C), Injured Trauma Survivor Screen (ITSS), and Both the AUDIT-C and the ITSS as a Function of Mechanism of Injury

of injuly									
	Fa	11	Gunshot	Wound	Motor Vehicle				
Screening	п	%	п	%	п	%	χ^2 (2)		
AUDIT-C	1,029/5,474	18.8 _a	208/1,184	17.6 _a	598/2,734	21.9 _b	14.311, <i>p</i> < .001		
ITSS	970/2,899	33.5 _a	344/678	50.7 _b	782/1,435	54.5 _b	200.185, <i>p</i> < .001		
AUDIT-C and ITSS	268/2,710	9.9 _a	65/567	11.5 _{a,b}	194/1,294	15.0 _b	22.362, <i>p</i> < .001		
Note. AUDIT-C = Alcohol	Use Disorders Identificat	ion Test—Consump	tion Items; ITSS = Injured Tr	auma Survivor Screen.	. Values that differ significa	ntly have different	subscripts.		

Gender Differences

Results for Model 1 (AUDIT-C × gender) revealed positive and significant main effects of MOI and gender on AUDIT-C. The interaction between gender and MOI was also a significant predictor of AUDIT-C. As shown in Figure 2, Model 1, within falls, the predicted probability of scoring a positive AUDIT-C was lower for females than for males, whereas the differences between gender for GSWs and MVCs were not different. For Model 2 (ITSS × gender), MOI and gender were once again important predictors of the ITSS score. The corresponding graph in Figure 2 (Model 2) shows significant differences between males and females within falls and MVCs but not GSWs. Males with falls were more likely than females with falls to score a positive ITSS, whereas the opposite was true for MVCs.

Race Differences

Model 3 (AUDIT-C \times race) also reports significant main and interactive effects of MOI and race on AUDIT-C. Figure 2 (Model 3) depicts these effects graphically. There are apparent differences between White and non-White respondents in the probability of scoring a positive AUDIT-C in both falls and GSWs but not MVCs.



Figure 2. Logistic regressions of independent variables: gender (Models 1 and 2), race (Models 3 and 4), and interaction with MOI to assess their moderating effect on AUDIT-C and ITSS scores. AUDIT-C = Alcohol Use Disorders Identification Test—Consumption Items; ITSS = Injured Trauma Survivor Screen; MOI = mechanism of injury.

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White respondents with falls were less likely to have a positive score, but White respondents with GSWs were more likely to have a positive score (although a particularly large confidence interval suggests caution in interpreting this difference). Model 4 (ITSS \times race) revealed mixed results. Race was not a significant predictor of the ITSS score on its own, but the interaction between race and GSW did reach statistical significance. Figure 2 (Model 4) illustrates that the predicted probability of a positive ITSS was different only between White and non-White respondents who experienced GSWs, with White respondents being less likely to have a positive score. Once again, however, a particularly large confidence interval suggests caution in interpreting this difference. White versus non-White respondents were nearly identical for ITSS scores for falls and MVCs.

COVID-19 Differences

The time frame before and after the declaration of the COVID-19 pandemic in March 2020 was analyzed for potential differences in the relationships among MOI and the results of AUDIT-C and ITSS screening. Data from 8,358 patients before COVID-19 and 2,032 patients after March 1, 2020, were examined. The differences between the proportions before and after the COVID-19 pandemic were significantly different, where falls were reduced during COVID-19 (57.2% to 52.4%, p < .001), and GSWs were increased during COVID-19 (13.8% to 17.7%, p < .001). However, there was no change in the proportion of MVCs from before to during COVID-19 (29.1% to 29.9%). When comparing AUDIT-C and ITSS within MOI, there was a statistically significant increase in hazardous drinking, depression, and/or PTSD, and co-occurrence of both in the fall population (χ^2 = 5.90, p = .015, χ^2 = 7.15, p < .001, χ^2 = 6.36, respectively, p = .012) from before to during the COVID-19 pandemic. There was no difference between time periods of hazardous drinking, depression and/or PTSD, and co-occurrence of both in the GSW population $(\chi^2 = 0.66, p = .41, \chi^2 = 0.45, p = .501, \chi^2 = 0.05, p =$.812, respectively). In the MVC group, between the two time periods, there was no increase of hazardous drinking ($\chi^2 = 2.64$, p = .104), but there was an increase in depression and/or PTSD and the co-occurrence of both $(\chi^2 = 9.59, p = .002, \chi^2 = 7.19, p = .007, respectively).$

DISCUSSION

The purpose of this study was to determine whether trauma patients' risk for AUD, depression, and PTSD differs on the basis of MOI and whether these relationships varied across race, gender, and during COVID-19. Motor vehicle collision patients screened positive (19.7%) for at-risk drinking, which was significantly higher than the proportions observed for either GSW or fall patients. These results are different from past findings, likely because previous data were grouped as intentional versus nonintentional MOI (Ramchand et al., 2009; Soderstrom et al., 1997). In the current sample, MVCs, otherwise coded as nonintentional trauma, were at a higher risk for hazardous drinking than intentional trauma (i.e., GSWs). This risk is important because in 2016, 10,497 people died in alcohol-impaired driving crashes, accounting for 28% of all traffic-related deaths in the United States (National Highway Traffic Safety Administration, 2016). In Wisconsin, where the present study was completed, alcohol-related deaths increased by 25% in 2020 (Wisconsin Policy Forum, 2022). Although our institution does not screen for acute alcohol intoxication on admission to the trauma center, there is a potential link between hazardous drinking or risk of AUD and the known association between alcohol impairment and MVC. Therefore, traumatically injured MVC patients who screen positive for AUD should be targeted for intervention specific to alcohol use and driving while impaired to prevent further alcohol misuse and MVCs.

Motor vehicle collision patients were also shown to be at increased risk for depression and PTSD (21.9%), particularly compared with fall patients. In our entire trauma population sample, 36.4% had both a positive AUDIT-C and ITSS, which is higher than studies that separate groups by classifying intentional and nonintentional injury (Shih et al., 2010; Zatzick et al., 2004). However, because prior studies did not separate out MOI, it is difficult to determine risk based on MOI from the current literature. Despite this, these observed values for MVC suggest that the combination of these risks is high and needs further attention for screening across trauma centers and the development of interventions to address mental health outcomes postinjury.

Further analyses identified that when looking at gender and race, AUDIT-C scores were highest in males with falls and among White patients sustaining GSWs. Regarding the probability of positive screening on the ITSS, a higher probability was observed for males versus females among fall patients, females versus males among MVC patients, and non-White versus White among GSW patients. Because this is the first known study to look at these differences in this way, it is important to replicate and extend this research to other trauma centers before firm conclusions can be made.

In the current sample, the COVID-19 pandemic appeared to be associated with an increased probability of hazardous drinking, depression and/or PTSD, and co-occurrence of both, but only for certain groups. In the fall group, hazardous drinking was stable, but there was an increase in depression and/or PTSD; in the MVC group, there was an increased co-occurrence of hazardous drinking and depression and/or PTSD; and in the GSW group, there was a stable risk for hazardous drinking and depression and/or PTSD and co-occurrence of both before and after the onset of the COVID-19 pandemic. Several studies have reported an increase in alcohol consumption during the pandemic among American adults (Grossman et al., 2020; Pollard et al., 2020) and an increase in alcohol-related complaints in emergency departments (Smalley et al., 2021). The results of the present study contribute to a growing literature suggesting an increase in hazardous drinking during the pandemic and particularly a greater risk for alcohol misuse among traumatic falls patients; hence, assessment of drinking behavior among trauma patients might help identify those who are likely to benefit from treatment for hazardous drinking and provide direction for treatment referrals and possible development of treatment options for selected injury mechanisms.

Limitations

The main limitation of this study is the single institution sample; hence the data cannot be generalized beyond the population served by this center. In addition, due to the low percentage of patients who endorsed a race other than White or African American, we had to combine patients into White versus non-White groups. Future research with larger, more diverse samples is needed to examine potential racial and ethnic differences further.

CONCLUSIONS

This study documented that trauma patients who sustain their injuries from MVC and GSW may be at particularly high risk for hazardous drinking, with and without comorbid depression and PTSD, and are thus potential populations to target for further intervention against further misuse and injury reoccurrence.

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Orcid iDs

Colleen M. Trevino https//orcid.org/ 0000-0002-7813-3642 Ryan C. Shorey https//orcid.org/0000-0002-0927-3959 Carisa Bergner https//orcid.org/0000-0002-0038-3991 Amber Brandolino https//orcid.org/ 0000-0002-4232-0630 Terri deRoon-Cassini https//orcid.org/0000-0002-9485-0625 Christopher R. France https//orcid.org/0000-0002-4723-0247

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