Published in final edited form as:

J Subst Abuse Treat. 2012 December ; 43(4): 410–417. doi:10.1016/j.jsat.2012.08.009.

Substance Use and PTSD Symptoms in Trauma Center Patients Receiving Mandated Alcohol SBI

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Abstract

In an effort to integrate substance abuse treatment at trauma centers, the American College of Surgeons has mandated alcohol screening and brief intervention (SBI). Few investigations have assessed trauma center inpatients for comorbidities that may impact the effectiveness of SBI that exclusively focuses on alcohol. Randomly selected SBI eligible acute care medical inpatients (N=878) were evaluated for alcohol, illegal drugs, and symptoms consistent with a diagnosis of posttraumatic stress disorder (PTSD) using electronic medical record, toxicology, and self-report assessments; 79% of all patients had one or more alcohol, illegal drug, or PTSD symptom comorbidity. Over 70% of patients receiving alcohol SBI (n=166) demonstrated one or more illegal drug or PTSD symptom comorbidity. A majority of trauma center inpatients have comorbidities that may impact the effectiveness of mandated alcohol SBI. Investigations that realistically capture, account for, and intervene upon these common comorbid presentations are required to inform the iterative development of College policy targeting integrated substance abuse treatment at trauma centers.

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1. Introduction

The American College of Surgeons tightly regulates the delivery of care in acute care medical, trauma center settings (American College of Surgeons Committee on Trauma, 2006). In an initial effort to integrate substance abuse treatment at trauma centers, the American College of Surgeons has mandated alcohol screening and brief intervention procedures (American College of Surgeons Committee on Trauma, 2006; Terrell et al., 2008). Level I and II trauma centers are required to have a mechanism to identify patients who are problem drinkers. In addition, Level I centers must have the capability to provide an intervention for patients identified as problem drinkers (American College of Surgeons Committee on Trauma, 2006). Trauma centers that are found not to be performing alcohol SBI during American College of Surgeons verification site visits, risk losing College accreditation and associated federal funding (American College of Surgeons Committee on Trauma, 2006; United States Congress, 2010). Passed in 2005, the American College of Surgeons' requirement represents the first mandatory nationwide policy effort targeting the integration of substance related screening and intervention services in an acute or primary care general medical setting (American College of Surgeons Committee on Trauma, 2006; Terrell et al., 2008).

Prior investigation suggests that approximately 20–40% of traumatically injured patients hospitalized at United States (U.S.) trauma centers have high levels of PTSD symptom comorbidity (Holbrook, Anderson, Sieber, Browner, & Hoyt, 1999; Michaels et al., 1999; Shih, Schell, Hambarsoomian, Belzberg, & Marshall, 2010; Zatzick et al., 2004a; Zatzick et al., 2000; Zatzick et al., 2007; Zatzick et al., 2005). Emerging literature suggests that traumatic life events and PTSD symptoms can serve to complicate the treatment of alcohol and drug use problems (Hien, Campbell, Ruglass, Hu, & Killeen, 2010; Hien et al., 2010; Kaysen et al., 2006; Reijneveld, Crone, Schuller, Verhulst, & Verloove-Vanhorick, 2005; Torchalla, Nosen, Rostam, & Allen, 2012).

Other investigations have documented high rates of alcohol and illegal drug use comorbidities among injured inpatients admitted to U.S. trauma centers (Gentilello et al., 1999; Ramchand et al., 2009; Socie, Duffy, & Erskine, 2012; Soderstrom et al., 1997; Zatzick et al., 2000; Zatzick et al., 2007). Comorbid drug use problems can also complicate the delivery of routine alcohol SBI (Dunn et al., 2003; Madras et al., 2009; Saitz et al., 2010).

A comprehensive understanding of the full spectrum of alcohol, illegal drugs, and PTSD symptomatic comorbidity becomes particularly important in light of recent American College of Surgeons mandates for alcohol SBI. As part of the nationwide rollout of the mandate, the American College of Surgeons has sponsored a series of publications and trainings specifically targeting alcohol SBI (American College of Surgeons, U.S. Department of Health and Human Services, & Transportation, 2010). Nationwide surveys of trauma center practice, in the wake of the alcohol SBI mandate, suggest that trauma centers are opting for more efficient alcohol laboratory toxicology screening tests over questionnaire assessments (Terrell et al., 2008). Literature review, however, revealed no investigations that assessed the extent to which patients receiving alcohol SBI have comorbid illegal drug use problems or PTSD symptoms. A better understanding of comorbid presentations among injured inpatients receiving mandated SBI has the potential to advance the integration of substance related SBI at trauma centers. Investigations that clarify the nature and extent of comorbid presentations in representative samples of injured trauma survivors can inform the necessity of screening procedures that systematically capture not only alcohol, but other drugs of abuse and comorbid mental disorders such as PTSD. Also, the presence of multiple comorbid disorders and symptomatic presentations could inform the evolution of brief

intervention and referral services that serve to link injured trauma center inpatients to primary care and community substance use treatment.

The overarching goal of this investigation was to further the integration of substance related screening, intervention, and referral services into routine care at U.S. trauma centers. The investigation first aimed to use clinical epidemiologic methods to identify alcohol, illegal drug, and PTSD symptom comorbidity among randomly sampled trauma center inpatients. The investigation also aimed to comprehensively understand the comorbidity profile of the sub-sample of trauma center inpatients receiving mandated alcohol SBI. We hypothesized that both the randomly sampled study cohort and the sub-sample of patients seen for mandated alcohol SBI would have high rates of illegal drug use and PTSD symptom comorbidity.

2. Materials and Methods

2.1. Design and Setting

Study participants were injured trauma survivors who were being assessed for recruitment into a stepped care intervention trial (Zatzick et al., 2011). The University of Washington Institutional Review Board approved all study procedures prior to initiating the protocol. Between April 2006 and September 2009, injured trauma survivors admitted to the University of Washington's Harborview Level I trauma center were randomly approached at bedside for participation by study research associates. Each weekday morning, a research associate downloaded a list of all newly admitted injured patients derived from the electronic medical record (EMR). The research associate assigned random numbers for approach to all patients who met study eligibility criteria, then approached injured inpatients in the order dictated by the random number assignments. Patients included in the investigation were consented for the study a median of four hospital days (interquartile range = 7 days) after their surgical inpatient admission. After providing written informed consent, participants were assessed for alcohol, illegal drugs, and PTSD symptoms.

2.2. Participants

The investigators screened English-speaking women and men ages 18 and older, who presented to the trauma center with injuries severe enough to require inpatient surgical admission. Patients who required immediate psychiatric intervention (i.e., self-inflicted injury, active psychosis) or who were currently incarcerated were excluded. Patients who lived at great distances from the trauma center (i.e., > 100 miles) were also excluded from the study protocol, as they were less likely to benefit from the stepped care intervention procedure (Zatzick et al., 2011).

2.3. Alcohol Screening and Brief Intervention

Since the passage of the alcohol mandate, the primary method for alcohol screening at Harborview has been blood alcohol concentration (BAC) toxicology testing. The Harborview Medical Center Addiction Intervention Service (CD director), a clinical service affiliated with the Harborview Medical Center Inpatient Consultation Liaison Service (DZ director), provides mandate concordant alcohol SBI. The Addiction Intervention Service provides alcohol SBI on weekdays from 8 am to 5 pm. The service utilizes a number of methods to identify patients for SBI. A centralized computer generated query that aggregates all hospital blood alcohol levels has been developed as an efficient population-based alcohol screening procedure. Addiction Intervention Service providers execute the query, which requires approximately 5 minutes and are provided with a listing of all hospitalized injured BAC positive patients. The query is also designed to aggregate any EMR International Classification of Diseases, 9th Revision, *Clinical Modification (ICD-9-CM)* diagnoses of an

alcohol or drug disorder for all hospitalized patients; *ICD-9-CM* diagnostic codes captured by the query include all alcohol use disorders (291.0–291.3, 291.5, 291.8, 291.9, 303, 303.9, and 305), drug use disorders (292, 304, and 305.2–305.9), and poly-drug abuse and dependence (304.70–304.73, 304.80–304.83, 304.90–304.93, and 305.70–307.73). The Addiction Intervention Service also sees patients that are directly referred as consults from trauma center providers. Finally, independent of the automated screen and trauma center provider referrals, the Addiction Intervention Service performs routine questionnaire based alcohol screening on a smaller sub-sample of injured patients (Terrell et al., 2008). The Addiction Intervention Service leaves clinical notes in the EMR for all patients receiving SBI. These EMR notes are reviewed in order to document which patients in the study cohort had received mandated alcohol SBI.

2.4. Study Measures

In order to assess the full spectrum of alcohol, illegal drug, and PTSD symptom comorbidity among trauma center inpatients, the investigation utilized multiple-item self-report questionnaires, single-item self-report screens, chart recorded *ICD-9-CM* diagnoses, and blood and urine toxicology results. A positive result on any one self-report, toxicology screen, or chart indicator, constituted caseness for alcohol and other substance use problems.

2.5. Alcohol Use Problems

Multiple assessment methods were used to identify alcohol use problems. Alcohol use in the four weeks prior to the injury was assessed using the Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) items, consisting of the first three questions on the AUDIT (Babor, de la Fuente, Saunders, & Grant, 1989; Bradley et al., 2003; Bradley et al., 2007; Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). The AUDIT-C is a self-report instrument for screening to detect problem drinking. We used recommended AUDIT-C cutoffs of 4 for men and 3 for women to identify problem drinkers. Also, blood alcohol concentration levels at the time of the injury admission were assessed with laboratory blood toxicology testing. Finally, EMR *ICD-9-CM* alcohol disorder codes were also reviewed in order to identify patients with medical record identified alcohol use problems.

2.6. Illegal Drug Use

A single-item self-report screening question was administered five times in order to assess the frequency of illegal drug use including cannabis, cocaine, opiates, amphetamines, and hallucinogens over the past year. Adapted from the first item of the AUDIT, the screening question asked “in the 12 months before your injury, how often have you used” each illegal drug; the five response options included: never, monthly or less, 2–4 times per month, 2–3 times per week, and four or more times per week. Single-item screens have been used to assess drug use in primary and acute care medical patients (Ramchand et al., 2009; Smith, Schmidt, Allensworth-Davies, & Saitz, 2010). A positive drug screen was defined as any use in the past year. Illegal drug intoxication in the time period immediately before the injury admission was identified with urine toxicology drug screens. Electronic medical record *ICD-9-CM* drug disorder codes were also reviewed in order to identify patients with prior drug use problems.

2.7. PTSD Symptoms

PTSD symptoms were assessed with the PTSD Checklist Civilian Version (PCL-C) (Weathers & Ford, 1996; Weathers, Keane, & Davidson, 2001). The PTSD Checklist has established reliability and validity across trauma-exposed populations (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996; Bliese et al., 2008; Hoge et al., 2004; Zatzick et al., 2007). The measure includes 17 items that assess the American Psychiatric Association

Diagnostic and Statistical Manual (DSM-IV) PTSD criteria (American Psychiatric Association, 2000). Participants were asked to report how bothered they had been by each of the 17 PTSD symptoms, “since the event in which they were injured”, in order to ascertain high early PTSD symptom levels as surgical inpatients. Symptoms were rated on a five point Likert scale ranging from one (“not at all”) to five (“extremely”). The PTSD Checklist can be used to create an algorithm consistent with a diagnosis of PTSD by rating one intrusive, three avoidant, and two arousal symptoms, with a score of three (“moderately”) or greater. This algorithm was used to derive symptoms consistent with a diagnosis of PTSD among surgical inpatients.

2.8. Assessments: Other Clinical and Injury Characteristics

The investigation determined injury severity at baseline during the index admission from the electronic medical record *ICD-9-CM* codes using the Abbreviated Injury Scale and Injury Severity Score (Civil & Schwab, 1985; Johns Hopkins Health Services Research and Development Center, 1989). Insurance status, length of hospital, and intensive care unit stays, and other clinical and demographic characteristics (i.e., injury severity, age, gender), were abstracted from the trauma registry and electronic medical records.

2.9. Statistical Analyses

We first compared the demographic and clinical characteristics of all patients admitted to the trauma center with those included in the study using the χ^2 and t-test statistics, to assess the extent to which the sampling procedure produced a representative study cohort. We also performed a similar comparison of patients receiving mandated alcohol SBI versus all other patients included in the study cohort.

We next assessed the frequencies of patients who screened positive by self-report, toxicology, and EMR *ICD-9-CM* criteria for alcohol, illegal drugs (i.e., cannabis, cocaine, opiates, amphetamines, and hallucinogens), and poly-drug use for the entire study cohort. Frequencies of patients with symptoms consistent with a diagnosis of PTSD were also ascertained. The percentage of patients with alcohol, illegal drugs, and comorbid PTSD was also assessed. Finally, we performed sensitivity analyses that assessed the impact of varying the rates of self-report drug usage (i.e., any use in the past year, 2–4 times per month, 2–3 times per week, and four or more times per week) on the overall percentage of alcohol, illegal drug, and PTSD symptom comorbidity.

In order to better understand comorbidities among patients receiving mandated alcohol SBI, we compared rates of alcohol, illegal drugs, and PTSD symptom comorbidity in patients seen versus not seen by the Harborview Addiction Intervention Service. We also performed an exploratory Poisson regression analysis to ascertain which clinical, injury, and demographic factors characterized patients in the study cohort who were seen by the Addiction Intervention Service. Age, gender, injury type and severity, insurance status, intensive care unit admission, BAC, urine drug toxicology results, AUDIT-C, single-item illegal drug screens, PCL-C scores, and EMR substance related *ICD-9-CM* scores, were all entered into the model as potential predictors of being seen by the Addiction Intervention Service. Length of inpatient stay was controlled for in the model as an exposure/offset variable in order to adjust for the increased probability of being seen by the Addiction Intervention Service during longer hospital stays. Only variables with statistically significant associations with Addiction Intervention Service visits were retained in the final regression model.

3. Results

A total of 17,498 patients were admitted to the trauma surgery service during the time period of the investigation; 13,511 patients were excluded before approach as they did not meet study inclusion criteria (i.e., 3,307 age < 18, 3,303 living > 100 miles from trauma center, 3,155 scheduled, non-traumatic surgical admission, 1,187 non-English speaking, 716 enrolled in alternative acute care protocols, 657 cognitive impairment, 425 deceased, 397 acutely suicidal/self-inflicted injury, 230 incarcerated, and 134 acutely psychotic). Two thousand, seven hundred six patients were discharged before research associates could approach for consent. One thousand, two hundred eighty-one patients were approached for consent, with 403 (31%) refusing study participation. The 878 patients in the study cohort were significantly more likely to be younger, female, intentionally and less severely injured, have longer length of inpatient stays, and BAC positive (Table 1). In the study cohort, 741/878 (84%) received BAC testing. Patients seen by the Addiction Intervention Service were significantly more likely to be younger, more severely injured, have longer lengths of inpatient stay, and BAC positive, when compared to members of the study cohort not seen by the Addiction Intervention Service (Table 1).

Seventy-nine percent of patients in the study cohort had one or more alcohol, illegal drug, and/or PTSD comorbidity. Identification rates for alcohol and illegal drugs varied across self-report, toxicology, and EMR *ICD-9-CM* screening methods. Self-report consistently identified the greatest frequency of patients with substance use (Table 2). Over 50% of patients had one or more positive indicators of an alcohol use problem (Table 2). After alcohol, cannabis was the second most frequently used substance with 40% of patients having one or more positive indicators (Table 2); due to this high frequency of cannabis use, cannabis and other illegal drugs were presented as distinct categories in order to simplify the presentation of multiple comorbidities (Figures 1 and 2).

Seventy-four percent of the study cohort demonstrated one or more alcohol or illegal drug use problems (Figure 1). Over 40% of the study cohort presented with comorbid alcohol, cannabis, and/or other illegal drug use (Figure 1). Sensitivity analyses that assessed the impact of varying the rates of self-report drug usage did not substantially alter the magnitude or pattern of overall comorbidity in the sample.

One in four patients in the study cohort had symptoms consistent with a diagnosis of PTSD as surgical inpatients (Table 2). Frequencies of PTSD comorbidity ranged from 19–37% (χ^2 (7) 20.5, $p < 0.01$) across alcohol, cannabis, and other illegal drug use categories (Figure 2). Patients with no alcohol or illegal drug comorbidity had the lowest rates of PTSD, while patients with both alcohol and illegal drug comorbidity had among the highest rates of PTSD (Figure 2).

Beyond alcohol use problems, 70% of patients seen for SBI by the Addiction Intervention Service had one or more illegal drug or PTSD comorbidity. Patients seen by the Addiction Intervention Service were significantly more likely to have alcohol, cannabis, and cocaine, but not opiate or amphetamine comorbidities (Table 3). The rate of PTSD (25%) was essentially identical in patients seen and not seen by the Addiction Intervention Service (Table 3).

Regression analyses revealed that being BAC positive was the variable most strongly associated with Addiction Intervention Service SBI (Relative Risk (RR) = 5.86, 95% Confidence Interval (CI) = 4.20, 8.17). Having any *ICD-9-CM* substance related diagnosis also significantly increased the likelihood of being seen by the Addiction Intervention Service (RR = 1.88, 95% CI = 1.37, 2.60). Intensive care unit admission (RR = 0.62, 95% CI = 0.44, 0.87) and increasing injury severity (RR = 0.56, 95% CI = 0.37, 0.86) were

associated with a significantly diminished likelihood of being seen by the Addiction Intervention Service.

4. Discussion

This investigation used self-report, laboratory toxicology, and EMR data to assess alcohol, illegal drug, and PTSD comorbidities among randomly sampled acute care medical trauma center inpatients who were eligible to receive American College of Surgeons mandated alcohol SBI. The investigation found that 79% of hospitalized injured trauma survivors had one or more alcohol, illegal drug, and/or PTSD comorbidity. Soderstrom et al. (1997) reported that 54% of a consecutive sample of over 1,000 acute care medical trauma center inpatients had one or more lifetime alcohol or drug abuse/dependence diagnoses as ascertained by structured clinical interviews. The combination of alcohol and drug screening items, EMR *ICD-9-CM* substance related diagnoses, and blood and urine toxicology screening results may have yielded higher estimates of substance use problems in the current investigation, than would have been obtained exclusively by diagnostic assessments. Of particular note were the high frequencies of injured inpatients, who freely endorsed screening items assessing the use of illegal drugs.

Few investigations have comprehensively assessed alcohol, illegal drug, and PTSD comorbidities in large samples of acute care medical, trauma center inpatients. One quarter of trauma center inpatients endorsed symptoms consistent with a diagnosis of PTSD. Patients with alcohol and illegal drug comorbidity had among the highest observed rates of PTSD. In outpatient samples, PTSD symptoms can serve to complicate the treatment of alcohol and drug use problems (Hien, Campbell, Ruglass, Hu, & Killeen, 2010; Hien et al., 2010; Kaysen et al., 2006; Reijneveld et al., 2005; Torchalla et al., 2012). Individuals with comorbid PTSD and substance use may exhibit greater diagnostic complexity and higher symptomatic distress (Brady, Killeen, Saladin, Dansky, & Becker, 1994; Driessen et al., 2008). Individuals with comorbid presentations may self-medicate with substances in response to PTSD symptom fluctuations (Ouimette, Read, Wade, & Tirone, 2010). In a National Institute on Drug Abuse Clinical Trials Network multi-site study of outpatients with comorbid PTSD and substance use, study participants that evidenced PTSD symptom reductions were also more likely to demonstrate improvements in substance use symptoms (Hien et al., 2010). Among surgical inpatients, early high PTSD symptom levels are predictive of a broad spectrum of physical, social, and role impairments over the course of the year after injury (Holbrook et al., 1999; Ramchand, Marshall, Schell, & Jaycox, 2008; Zatzick et al., 2008a; Zatzick et al., 2008b). Thus, high early levels of PTSD symptoms and associated impairments may very well serve to complicate the delivery of routine SBI among trauma center inpatients.

The investigation provides some initial insight into routine trauma center alcohol SBI in the wake of the American College of Surgeons' mandate. Seventy percent of patients receiving mandated alcohol SBI had one or more illegal drug or PTSD comorbidity. Although a positive BAC was most strongly associated with receiving SBI, patients with EMR substance related diagnoses were also more frequently seen by the Addiction Intervention Service. Patients receiving mandated SBI were significantly more likely to demonstrate cannabis and cocaine comorbidity when compared to patients not being seen by the Addiction Intervention Service. Previous randomized and non-randomized clinical trials have reported on SBI targeting alcohol and drug comorbidity simultaneously (Madras et al., 2009; Magill, Barnett, Apodaca, Rohsenow, & Monti, 2009; McCambridge & Strang, 2004). In these general medical and school based samples, patients receiving broadly targeted alcohol and drug SBI demonstrated reductions in multiple substance use symptoms over time (Madras et al., 2009; Magill et al., 2009; McCambridge & Strang, 2004). The

assessment of the effectiveness of SBI on alcohol and drug use outcomes longitudinally was beyond the scope of the current investigation. The National Institute on Drug Abuse has sponsored a number of R01 studies that will follow-up SBI outcomes targeting multiple comorbidities in acute and primary care general medical patients (National Institute on Drug Abuse, 2008).

This study has some limitations. By including any chart, toxicology, or past year self-report indicator of a substance use problem, the investigation may be biased towards reporting of higher rates of alcohol and drug use disorders. This limitation is further complicated by the observation that the investigation did not provide confirmatory assessments of self-report, laboratory, and EMR screening with diagnostic interviews. Also, the sampling protocol employed for the stepped care clinical trial may have excluded important subgroups of hospitalized inpatients (e.g., patients living at distances greater than 100 miles from the trauma center, patients discharged over the weekend or at night). The ability to directly compare the demographic, clinical, and injury characteristics of the study cohort, with all patients admitted to the trauma center during the time period of the study, partially mitigates this concern. Although these comparisons were driven towards statistical significance by large sample sizes, there were clinically relevant differences between the study cohort and the population of patients admitted to the trauma center, including less severe injury, younger age, and perhaps most importantly, a greater percentage of BAC positive patients in the study cohort. An additional limitation of the study is the exclusive use of symptoms consistent with a diagnosis of PTSD as the only PTSD indicator. The investigation performed a limited assessment of prescription drug use and abuse. Paramedics routinely administer benzodiazepines and opiates to injured trauma survivors prior to trauma center admission, thus complicating the use of urine toxicology screens to estimate frequencies of abuse for these substances. Due to the complicated nature of this assessment, benzodiazepine and opiate positive results were excluded from initial acute care toxicology screen assessments in the current investigation. Finally, the investigation is limited by an incomplete assessment of Addiction Intervention Service screening and referral practices. A more detailed understanding of Addiction Intervention Service practices, as well as screening considerations for patients with high PTSD symptom levels, could be important areas for future study.

Beyond these considerations, the current investigation contributes to an evolving literature on the integration of screening and brief intervention services for substance abusing patients in acute and primary care medical settings. A series of previous investigations and reviews describe attempts to integrate substance use services in primary care medical settings (Barry et al., 2010; Gordon et al., 2008; Gordon, Kunins, Rastegar, Tetrault, & Walley, 2011; Saitz et al., 2010; Saitz, Larson, Labelle, Richardson, & Samet, 2008; Squires, Alford, Bernstein, Palfai, & Saitz, 2010), and acute care medical, emergency department settings (Cunningham et al., 2009; D'Onofrio & Degutis, 2010; D'Onofrio et al., 2010). From an implementation science perspective, acute care medical, trauma center inpatient settings are distinct from other primary and acute care settings in that the American College of Surgeons has the ability to mandate SBI procedures. Thus, the integration of substance use services at United States trauma centers is occurring in a unique regulatory "make it happen" context, in contrast to a negotiated "help it happen" implementation context in other general medical settings (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005; Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou, 2004; Grol, Bosch, Hulscher, Eccles, & Wensing, 2007; Perl, 2011). The American College of Surgeons has demonstrated its commitment to using empiric data to further the integration of substance use screening and brief intervention at trauma centers (American College of Surgeons Committee on Trauma, 2006). The results of this investigation suggest that the current mandate for alcohol screening and brief intervention, and associated college training activities will need to consider the high

prevalence of illegal drug and PTSD comorbidities. Because these comorbidities can complicate SBI, routine screening procedures may need to move beyond laboratory BAC or isolated alcohol screens to incorporate illegal drugs and PTSD. Perhaps most importantly future pragmatic trials of screening, intervention, and referral to treatment services will need to realistically capture and account for these common comorbid presentations, in order to optimally inform the iterative development of American College of Surgeons' policy targeting integrated substance abuse treatment at trauma centers.

An evolving literature suggests that early interventions delivered from acute care medical settings can reduce PTSD symptoms among injured trauma survivors (Kearns et al., Accepted for Publication). One particularly promising approach with regard to integration of combined substance abuse and PTSD treatment in general medical settings is stepped collaborative care intervention models (Zatzick et al., Accepted for Publication; Zatzick et al., 2011; Zatzick et al., 2004b). Stepped collaborative care interventions have incorporated early post-injury care management with embedded motivational interviewing targeting reductions in alcohol consumption. Measurement based care approaches have been used in these stepped care models to target patients with persistent PTSD symptoms who receive evidence-based medication and pharmacotherapy treatment in later stages of care (Zatzick et al., Accepted for Publication; Zatzick et al., 2011; Zatzick et al., 2004b). Two randomized effectiveness trials of stepped care for injured trauma survivors have demonstrated clinically and statistically significant reductions in alcohol consumption and PTSD symptoms over the course of the year post-injury in intervention patients when compared to usual care control patients (Zatzick et al., Accepted for Publication; Zatzick et al., 2004b). In an effort to further the integration of substance abuse treatment in acute care medical settings, future randomized stepped care intervention trials could expand beyond alcohol use and PTSD to target the full spectrum of substance abuse comorbidities that appear to be endemic among injured patients treated at United States trauma centers.

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Figure I.
Breakdown of alcohol, cannabis, and other illegal drug use (i.e., cocaine, opiates, amphetamines, and hallucinogens) in the study cohort (N = 878).

Figure II.
PTSD comorbidity in the study cohort (N = 878).

Table 1

Demographic, clinical, and injury characteristics of admitted and study patients

Demographics	All Admits (N = 16,620)	Study Cohort (N = 878)	Test Statistic (χ^2 or <i>t</i> -test)	Seen by AIS (N = 166)	Not Seen by AIS (N = 712)	Test Statistic (χ^2 or <i>t</i> -test)
<i>Gender</i>						
Female	4,797 (28.9)	290 (33.0)	$\chi^2 (1) = 5.6^*$	54 (32.5)	236 (33.1)	$\chi^2 (1) = 0.00$
<i>Injury Type</i>						
Intentional	1,192 (7.2)	98 (11.2)	$\chi^2 (1) = 19.4^{***}$	20 (12.0)	78 (11.0)	$\chi^2 (1) = 0.07$
<i>ISS Category</i>						
< 9	3,521 (21.4)	208 (23.7)		34 (20.5)	174 (24.4)	
9–15	6,189 (37.7)	416 (47.4)	$\chi^2 (2) = 51.9^{***}$	68 (41.0)	348 (48.9)	$\chi^2 (2) = 9.22^{**}$
16	6,710 (40.9)	254 (28.9)		64 (38.6)	190 (26.7)	
<i>Alcohol (BAC)</i>						
Positive	3,299 (20.9)	250 (28.6)		117 (70.5)	133 (18.7)	
Negative	9,507 (60.2)	491 (56.1)	$\chi^2 (2) = 31.0^{***}$	44 (26.5)	447 (62.8)	$\chi^2 (2) = 179.34^{***}$
Not Drawn	2,987 (18.9)	134 (15.3)		5 (3.0)	132 (18.5)	
<i>Age (years)</i>						
Mean (SD)	45.8 (19.9)	38.2 (13.7)	$t(1082) = 15.7^{***}$	35.7 (12.6)	38.8 (14.0)	$t(876) = 2.58^{**}$
<i>LOS (days)^a</i>						
Mean (SD)	7.4 (11.0)	7.5 (9.0)	$t(999) = 5.6^{***}$	10.5 (12.4)	6.8 (7.9)	$t(876) = 5.92^{***}$

Note. AIS = Addiction Intervention Service, BAC = Blood alcohol concentration, ISS = Injury Severity Score, LOS = Length of stay, SD = Standard deviation.

^aLOS comparisons are in transformed.

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$.

Table 2

Alcohol, illegal drugs, and PTSD indicators in the study cohort

Comorbidity Assessed	Self-Report		Toxicology (N = 878)		Electronic Medical Record (N = 878)		One or More Positive Indicator	
	Measure	% (n)	Measure	% (n)	Measure	% (n)	% (n)	% (n)
<i>Alcohol</i>	AUDIT-C (N = 862)	45.7 (394)	BAC	28.5 (250)	Alcohol abuse or dependence	23.0 (202)		56.3 (494)
<i>Illegal Drugs</i>								
Cannabis	Single Item (N = 842)	36.6 (308)	Tox. Screen	18.1 (159)	Cannabis abuse or dependence	5.6 (49)		40.0 (351)
Other Drugs								
Cocaine	Single Item (N = 844)	16.1 (136)	Tox. Screen	10.6 (93)	Cocaine abuse or dependence	9.6 (84)		22.1 (194)
Opiates	Single Item (N = 844)	11.7 (99)	Tox. Screen	4.1 (36)	Opiate abuse or dependence	5.9 (52)		16.2 (142)
Amphetamines	Single Item (N = 844)	5.6 (47)	Tox. Screen	4.7 (41)	Amphetamine abuse or dependence	3.8 (33)		11.2 (98)
Hallucinogens	Single Item (N = 844)	2.8 (24)	Tox. Screen	0.3 (3)	--	--		3.1 (27)
Poly-Drug					Poly-drug abuse or dependence	7.3 (6.4)		
<i>PTSD</i>	PCL-C Algorithm	25.2 (221)						

Note. AUDIT-C = Alcohol Use Disorders Identification Test-Consumption items, BAC = Blood alcohol concentration, PCL-C Algorithm = PTSD Checklist Civilian Version symptoms consistent with a DSM-IV diagnosis of PTSD, PTSD = Posttraumatic Stress Disorder, Tox. Screen = Urine toxicology screen.

Table 3
 Characteristics of patients seen and not seen by the Addiction Intervention Service (N = 878)

Category	<u>Seen by AIS (n = 166)</u>		<u>Not Seen by AIS (n = 712)</u>		p
	% (n)	% (n)	% (n)	% (n)	
<i>Alcohol</i>	83.1 (138)	50.0 (356)			< 0.0001
<i>Illegal Drugs</i>					
Cannabis	50.6 (84)	37.5 (267)			0.002
Other Drugs					
Cocaine	28.9 (48)	20.5 (146)			0.02
Opiates	16.9 (28)	16.0 (114)			0.81
Amphetamines	15.1 (25)	10.3 (73)			0.10
Hallucinogens	3.0 (5)	2.7 (19)			1.00
<i>PTSD PCL-C Algorithm</i>	25.3 (42)	25.1 (179)			0.52
<i>Alcohol, Cannabis and Other Drugs Use Categories</i>					< 0.0001
No Use	9.6 (16)	29.8 (212)			
Alcohol Only	28.3 (47)	17.7 (126)			
Alcohol, Cannabis, and Other Drugs	25.3 (42)	11.9 (85)			
Alcohol and Cannabis	18.7 (31)	11.8 (84)			
Alcohol and Other Drugs	10.8 (18)	8.6 (61)			
Cannabis and Other Drugs	4.2 (7)	6.7 (48)			
Cannabis Only	2.4 (4)	7.0 (50)			
Other Drugs Only	0.6 (1)	6.5 (46)			

Note. Other drugs include cocaine, opiates, amphetamines, and hallucinogens.

AIS = Addiction Intervention Service, PCL-C Algorithm = PTSD Checklist Civilian Version symptoms consistent with a DSM-IV diagnosis of PTSD, PTSD = Posttraumatic Stress Disorder.