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Disseminating Alcohol Screening and Brief Intervention at Trauma Centers: A Policy Relevant Cluster Randomized Effectiveness Trial

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Abstract

Background and aims—In 2005 the American College of Surgeons passed a mandate requiring that Level I trauma centers have mechanisms to identify and intervene with problem drinkers. The aim of this investigation was to determine if a multilevel trauma center intervention targeting both providers and patients would lead to higher quality alcohol screening and brief intervention (SBI) when compared with trauma center mandate compliance without implementation enhancements.

Design—Cluster randomized trial in which intervention site (site n =10, patient n =409) providers received 1-day workshop training on evidence-based motivational interviewing (MI) alcohol interventions and four 30-minute feedback and coaching sessions; control sites (site n =10, patient n =469) implemented the mandate without study team training enhancements.

Setting—Trauma centers in the United States of America.

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Participants—878 blood alcohol positive inpatients with and without traumatic brain injury (TBI).

Measurements—MI skills of providers were assessed with fidelity coded standardized patient interviews. All patients were interviewed at baseline, and 6- and 12-months post-injury with the Alcohol Use Disorders Identification Test (AUDIT).

Findings—Intervention site providers consistently demonstrated enhanced MI skills compared with control providers. Intervention patients demonstrated an 8% reduction in AUDIT hazardous drinking relative to controls over the course of the year after injury (RR =0.88, 95%, CI =0.79, 0.98). Intervention patients were more likely to demonstrate improvements in alcohol use problems in the absence of TBI (p =0.002).

Conclusion—Trauma center providers can be trained to deliver higher quality alcohol screening and brief intervention than untrained providers, which is associated with modest reductions in alcohol use problems, particularly among patients without traumatic brain injury.

Keywords

Alcohol; Screening and Brief Intervention; Traumatic Injury; American College of Surgeons; Policy Mandate; Motivational Interviewing; Dissemination and Implementation Research

INTRODUCTION

Across civilian and veteran health service delivery sectors, the quality of care for alcohol use problems lags behind many other health care conditions (1, 2). Each year in the United States, over 30 million individuals present to acute care medical settings for the treatment of traumatic injury, and 1.5–2.5 million Americans are so severely injured that they require inpatient surgical hospitalization (3–7). A series of investigations have established that alcohol use problems are endemic among injured trauma survivors (8, 9). Also, studies in both civilian and veteran trauma exposed patient populations now suggest that individuals with traumatic brain injury (TBI) and associated impairments may be particularly vulnerable to the development of alcohol use problems (10, 11). Thus, the widespread integration of high quality alcohol screening and brief intervention (SBI) into acute injury care has the potential to markedly increase the population impact of prevention efforts and has been a long-standing international public health objective (12–16).

In 2005, the American College of Surgeons, the primary agency responsible for developing trauma center regulatory requirements, passed a mandate requiring that Level I trauma centers have a mechanism to identify patients who are problem drinkers and have the capacity to provide an intervention for patients who are alcohol screen positive (6, 17). This represents the first ever United States policy mandate for the integrated treatment of alcohol use problems in a general medical setting.

Evidence from single site randomized clinical trials suggests that interventions derived from motivational interviewing (MI) principles may reduce alcohol consumption and related alcohol use problems among patients presenting to trauma center settings (18–21). However,

negative trials have been reported (22–24). Commentary has encouraged the expansion of alcohol SBI trials to include studies of system level implementation efforts (24).

Although the College mandate is an enormous first step, specific alcohol SBI procedures are being left to the discretion of each trauma center. Initial reports suggest that the mandate is being implemented with marked variability (17), and there is a risk that lower quality alcohol SBI procedures could become the default standard of trauma center care nationwide. The goal of the Disseminating Organizational Screening and Brief Intervention Services (DO-SBIS) at trauma centers cluster randomized trial was to harness the opportunity afforded by the College mandate by testing the delivery of high quality, evidence-based alcohol SBI at United States trauma centers. The investigation hypothesized that providers trained in evidence-based alcohol SBI delivery at intervention trauma centers would implement higher quality SBI when compared to providers at control sites. The investigation also hypothesized that patients receiving higher quality alcohol SBI from trained providers at intervention sites would demonstrate reductions in alcohol consumption and related alcohol use problems when compared to patients at control sites. A secondary aim of the investigation was to compare the impact of the alcohol screening and brief intervention protocol for patients with and without TBI.

METHODS

Design overview and selection of trauma center sites (25)

The University of Washington's IRB and each participating site IRB approved all study procedures prior to full protocol initiation. The DO-SBIS investigation tested, in a cluster randomized clinical trial design, the effects of a multilevel (i.e., center and patient level) intervention targeting the delivery of high quality alcohol SBI services at 20 United States Level I trauma centers. Intervention (n=10) and control (n=10) trauma center provider and patient outcome variables were assessed pre-randomization and followed longitudinally.

American College of Surgeons verified Level I "middle adopter" (26) trauma centers were targeted for inclusion in the DO-SBIS trial (17, 25). Sites classified as innovators and early adopters demonstrated well developed alcohol SBI services and had established trauma surgical and SBI provider champions. Late adopter and laggard sites had few champions, and displayed little interest in SBI service development. Middle adopter sites fell between these two extremes, demonstrating interest in alcohol service development, but with few well established services or champions. In contrast to innovator and/or early adopter sites, middle adopter sites had never received grant funding for alcohol related research or service development. In contrast to laggard sites, middle adopter sites endorsed enthusiasm about potential study participation. Middle adopter sites were selected for participation in the study as they were anticipated to be receptive to implementing alcohol SBI, yet unlikely to implement high quality services without additional training (26). The characteristics of all potential Level I trauma center sites (N=206) were assessed via review of American Hospital Directory web listings; follow-up in-depth telephone interviews were conducted with staff at potential middle adopter sites (17, 25).

Randomization

Site randomization occurred in a 1:1 ratio. A series of blocks of either 2 or 4 sites were generated using a random number generator by the investigation's statistician. Once generated, intervention and control site assignments were entered into 20 sequentially numbered envelopes. Site randomization was then conducted by a blinded research coordinator. Patients included in the trial were blinded to site intervention and control group status.

Patient Recruitment

Patient recruitment for the trial began in May of 2009 and ended in September of 2011. To be eligible for study enrollment all patients were required to have a score of 15/15 on the Glasgow Coma Scale (27) and to have a score ≥ 7 on a modified version of the Folstein Mini-Mental Status Examination (28). Participants recruited into the trial were male and female survivors of intentional and unintentional injuries, age ≥ 18 who had a positive blood alcohol concentration test upon admission. Patients with self-inflicted intentional injuries that constituted suicide attempts were excluded from the protocol as these patients frequently receive more intensive psychiatric trauma center care beyond alcohol SBI (29). Monolingual non-English speaking injury survivors and prisoners were also excluded from the trial.

After patients consented to the protocol and had received their baseline assessment from trauma center providers, SBI providers at intervention and control trauma center sites were instructed to deliver brief bedside interventions targeting risky drinking. Patients with Alcohol Use Disorders Identification Test (AUDIT) (30) scores ≥ 20 on the baseline assessment were also excluded from the protocol as effective treatment for these patients may require more intensive referral to treatment procedures (7, 30).

Intervention trauma centers

The MI intervention taught to intervention sites had been developed and successfully implemented by the study team with front-line trauma center providers over the past decade (18, 19, 25, 29). Motivational interviewing approaches encourage movement in the direction of reductions in risky drinking behaviors by collaboratively promoting conversations that aim to strengthen an individual patient's motivation and commitment to change (31). Intervention site nursing and social work SBI providers learned to deliver MI during a one-day workshop delivered by the study trainer (CD). The workshop training targeted a 20–30 minute MI that could be delivered at bedside to injured inpatients by the full spectrum of trauma center providers (e.g., social work and nursing providers) (32). The workshop emphasized MI skill development and the importance of spending adequate time conducting interventions by the bedside with injured inpatients (32). The on-site workshop was followed over the next six months by four trainer-led 30-minute telephone coaching sessions during which MI skills were practiced and subsequently boosted with written feedback via email. Following the six month training period intervention site SBI providers delivered bedside SBI to injured patients.

Control trauma centers

Control trauma centers implemented alcohol SBI without study team training enhancements. Control sites were permitted to implement mandated alcohol SBI with the assistance of any available guidelines, electronic or print training material, or private, state, or federal resources.

Outcome assessments

Provider and patient outcomes were collected longitudinally in order to assess the impact of the multilevel intervention over time (25). All research assistants conducting 6- and 12-month patient telephone follow-up and coding standardized patient interviews were blinded to intervention and control group status.

Provider Outcomes

In order to assess MI skills, intervention and control SBI providers participated in a total of seven 20-minute standardized patient-actor telephone interviews during which brief interventions were simulated (25). Prior to randomization, baseline standardized patient interviews took place with SBI providers at all 20 sites. Intervention site providers were scheduled for standardized patient interviews one week after workshop training and then again at 1-, 4-, 7-, 17-, and 27-months. Control site providers underwent a comparable sequencing of standardized patient assessments. Standardized patient scenarios were designed to reflect increasing clinical complexity over time. Initially standardized patient actors role-played injured patient scenarios that reflected optimal readiness to change at-risk drinking behaviors (e.g., the baseline, pre-randomization standardized patient was in "action"), while later standardized patients presented more difficult scenarios (e.g., the final 27-month standardized patient was "pre-contemplative") (25, 32).

Each standardized patient interview was scored using the Motivational Interviewing Treatment Integrity (MITI) coding system (33). Domains assessed by the MITI include the frequency of specific MI concordant behaviors such as counts of the delivery of open-ended questions. The MITI has established reliability and validity, and MITI coding procedures have been manualized (33).

The DO-SBIS trial aimed to have one provider intervene with all blood alcohol positive patients at each of the 20 trauma center sites. At 12 sites one provider intervened with all patients. At the remaining sites staff turnover dictated that more than one provider intervene; 6 sites had 2 interventionists, and 2 sites had 3 interventionists (total provider N=30).

Patient outcomes

Alcohol consumption and related alcohol use problems were assessed via patient self-report (34). The AUDIT was used as the primary patient alcohol outcome assessment (30). The AUDIT is a 10-item screening instrument for the early identification of problem drinkers and can be dichotomized to produce a score indicative of hazardous drinking (primary study outcome), or used as a continuous measure (30, 35). The AUDIT was administered to all patients (N = 878), at baseline during the inpatient hospital admission, and again 6- and 12-months after injury admission over the telephone (30).

To augment the AUDIT, the Form 90 alcohol timeline follow-back assessment method was used to assess abstinent and binge drinking days at 6- and 12-month follow-up (36–38). During the course of the study, 5% of Form 90 assessments were audio-taped and re-coded by a second group of raters; an intraclass correlation coefficient of 0.99 was attained for Form 90 rating comparison of abstinent days. The 6- and 12-month interviews included the Short Inventory of Problems (SIP) that assessed other negative consequences of alcohol consumption including episodes of driving under the influence of alcohol, and recurrent traumatic life events (39).

The investigation determined injury severity during the index admission from the medical record *ICD-9-CM Codes* using the Injury Severity Score (40, 41). Traumatic brain injury was also prospectively identified in the medical record (42). Laboratory blood alcohol positive toxicology results, length of hospital and intensive care unit stays, and other clinical characteristics were abstracted from the trauma registry data. Intervention and control SBI providers also documented the time they spent by the bedside with each patient.

Data Analyses

The investigation compared MI skill levels between intervention and control group site SBI providers. Mixed effects hierarchical regression models (43) were used to examine whether intervention and control site providers and patients manifested different patterns of change in outcomes over time. A particular strength of mixed effects hierarchical regression models is the ability to model patients nested within trauma center sites (44, 45). All patient outcome regression analyses accounted for the clustering of patients within trauma center sites, and all analyses were conducted on the intent-to-treat sample (46). For the models examining the continuous AUDIT, Form 90 abstinent and binge drinking days, and SIP outcomes, repeated measurements of the scale scores over time were the dependent variables. For the models examining dichotomized AUDIT hazardous drinking outcomes the investigation used Poisson regression with robust error variance to estimate relative risks (RRs) and 95% confidence intervals (CIs) (47, 48). The investigation was interested in identifying treatment group by time interaction effects, and interpreted any significant findings by examining change scores for the two treatment groups over time.

In addition exploratory analyses assessed the effect of provider MI skill levels on AUDIT scores by using the 5 MITI domains as time dependent covariates in a mediational analysis. Exploratory analyses also assessed the impact of TBI on treatment outcomes; patients were stratified with regard to TBI versus non-TBI status and all outcome analyses were repeated. Additional analyses were performed that included the imputation of values for missing data and the entry of covariates in regression models. SAS version 9.2 and SPSS version 18.0 were used for all analyses.

Sample size estimates for the investigation were derived from previous multisite trauma center trials (18, 19). Comparisons of blood alcohol concentrations from previous multi-site studies suggested an intraclass correlation coefficient = 0.00028 across trauma center sites (19). Assuming an effect size of 0.18, a correlation of 0.70 across assessments, an intraclass correlation coefficient = 0.00028, $\alpha = 0.05$, and 30% 12-month attrition, to attain 80% power

the investigation required recruitment of 800 patients (40 patients*20 sites) in order to retain 520 patients at the 12-month post-injury follow-up.

RESULTS

Characteristics of participants

A total of 2501 patients were approached at the 20 sites for consent into the trial and 1200 (48%) refused consent (Figure 1). Approximately 50% of the 878 randomized patients had incurred TBI (Table 1).

Provider outcomes

Regression analyses revealed that intervention site providers relative to control demonstrated significantly greater MI skill levels (i.e., group by time interaction effect) for the MITI domains of Global Spirit ($F(6,152) = 2.36$, $P = 0.03$), MI Adherent Behaviors ($F(6,153) = 4.69$, $P = 0.0002$), Percentage Open Ended Questions ($F(6,154) = 3.15$, $P = 0.006$), Reflection-to-Question Ratio ($F(6,153) = 3.74$, $P = 0.002$), and Complex Reflections (main effect, $F(1,159) = 15.25$, $P = 0.0001$), (Table 2). In four of the five MITI domains, these significant improvements were retained over the course of the study (Table 2). Also, providers at intervention sites spent significantly more time by the bedside delivering alcohol SBI when compared to control site providers (Intervention mean minutes = 33.4, SD = 13.4, control mean minutes = 16.2, SD = 14.2, $P = 0.002$).

Patient outcomes

Both intervention and control site patients showed reductions in AUDIT scale scores over the course of the year after injury (Table 3). Intervention patients demonstrated an 8% reduction in AUDIT hazardous drinking cutoffs relative to controls (RR = 0.88, 95% CI= 0.79, 0.98). Regression analyses also demonstrated significant reductions in continuous AUDIT scores in intervention site patients compared to controls (Table 3, Group by time effect $F(2, 1449) = 3.45$, ($P = 0.03$). In mediational analyses, when the MITI domains were entered into the dichotomous AUDIT outcome regression model, the treatment group by time interaction effect was no longer significant ($P = 0.14$). When provider time spent by the bedside was entered into the regression model the group by time interaction effect remained significant ($P = 0.03$).

Intervention patients also showed a significant increase in days abstinent from drinking alcohol over the course of the year (group by time effect $F(1, 589) = 5.05$, ($P = 0.02$). No significant differences in Form 90 binge drinking or SIP scores were observed between intervention and control patients (Table 3). Additional analyses including multiple imputations did not substantially alter the magnitude, pattern, or significance of the observed treatment effects.

Analyses that stratified patients by TBI status revealed significant interaction effects for AUDIT dichotomous ($P = 0.002$), AUDIT continuous ($P = 0.04$), and abstinent days ($P = 0.05$) outcomes. Over the course of the year after injury, intervention patients without TBI

when compared to control patients without TBI demonstrated a 15% reduction in AUDIT at-risk drinking (Figure 2).

DISCUSSION

This investigation found that a multifaceted organizational intervention targeting the delivery of high quality SBI can enhance trauma center provider and patient outcomes in the wake of the American College of Surgeons' alcohol policy mandate. Front-line trauma center providers receiving evidence-based alcohol SBI workshop training, feedback, and coaching consistently administered higher quality alcohol SBI as evidenced by sustained improvements in MI skills.

Patients receiving interventions from study team trained providers demonstrated a clinically modest yet statistically significant 8% reduction in hazardous drinking over the course of the year after hospital admission. Patients receiving the intervention who did not have TBI demonstrated the greatest reductions in hazardous drinking. Exploratory analyses suggested that provider MI skill levels may mediate the association between the intervention and alcohol use outcomes.

From a public health perspective these findings suggest that a brief trauma center intervention based upon MI principles can yield relevant population level reductions in alcohol consumption and related hazardous drinking outcomes (16, 49). Prior investigation and review suggests that alcohol SBI appears to be generally effective in trauma center, emergency department, medical inpatient, and primary care general medical settings although treatment effects may vary across these diverse contexts (16, 24, 49–56). The United States Preventive Task Force reviews of behavioral counseling for alcohol misuse in primary care reports at-risk drinking reductions of 12% (95% CI, 0.07 to 0.16) across 7 trials with a total of 2,737 participants (16). In the current trial, the statistically significant 8% global reduction in at-risk drinking falls within these confidence estimates and may be considered to have an important overall population or public health impact; (12) the 15% reduction observed in intervention trauma center patients without TBI falls at the upper end of these confidence estimates.

This multi-site trauma center investigation suggests that the effectiveness of alcohol SBI may be diminished by the presence of TBI (57). Future investigation may be required to test the effectiveness of SBI tailored to the distinct co-morbidity profiles of patients with TBI that can include posttraumatic stress and depressive symptoms, and cognitive impairments (10, 58).

The trauma center context influenced a number of important design considerations and related study limitations. First, there were a high percentage of refusals in this pragmatic clinical trial where study interventionists approached a convenience sample of blood alcohol positive injured inpatients for trial participation. The use of front-line trauma center clinical providers both as study interventionists and recruiters may have increased refusal rates; the investigative group's single site trauma center studies that employed trained research assistants as recruiters have attained substantially lower refusal rates (19, 29). Also, although

all outcome data are derived from patient self-report, the investigation used a reliable timeline follow-back method to document alcohol use and related problems (37). No significant group differences were observed for binge drinking or for other negative drinking consequences; a number of study design considerations including potential for assessment reactivity, exposure to non-study related alcohol SBI training, and the possible training effect of repeated standardized patient interviews could have contributed to reductions in observed treatment effects (17, 25, 59, 60). Finally, the current manuscript does not include a comprehensive cost-effectiveness analysis that would aid in determining whether the statistically significant, yet modest clinical reductions in alcohol consumption observed in the investigation are associated with substantial cost savings from the individual, trauma center or societal perspective. Of note, intervention training costs that included workshop with feedback and coaching in the current investigation were approximately $4,500 (61); these costs do not appear to be substantially different from the costs associated with the American College of Surgeons' post-alcohol mandate sponsored stand-alone workshop training sessions (6, 7, 61, 62).

Beyond these considerations, this investigation contributes to an evolving literature on the widespread implementation of alcohol SBI in the acute care medical, trauma center setting. A series of previous investigations and reviews describe attempts to integrate services for alcohol and other drug use problems in general medical settings including trauma center, emergency department, medical inpatient, and primary care contexts (54–56, 63). From an implementation science perspective, trauma center settings are distinct from other United States general medical settings in that the College has the ability to mandate alcohol SBI. Thus the integration of substance use services at Untied States trauma centers is occurring in a unique regulatory context, in contrast to a "negotiated" implementation context in other general medical settings (64). The College has demonstrated its commitment to using empiric data derived from pragmatic trials to inform policy targeting the integration of alcohol SBI at United States trauma centers (6). The results of the DO-SBIS study suggest that in the wake of the College policy mandate, front-line trauma center providers can be trained in the delivery of higher quality alcohol SBI that is associated with diminished alcohol consumption and alcohol use problems particularly among patients without TBI (6, 17). Orchestrating policy, provider implementation efforts, and research findings can ensure higher quality alcohol services are implemented at trauma centers, and may be a model for the integration of evidence-based alcohol SBI in other general medical settings in the United States and internationally (13–15).

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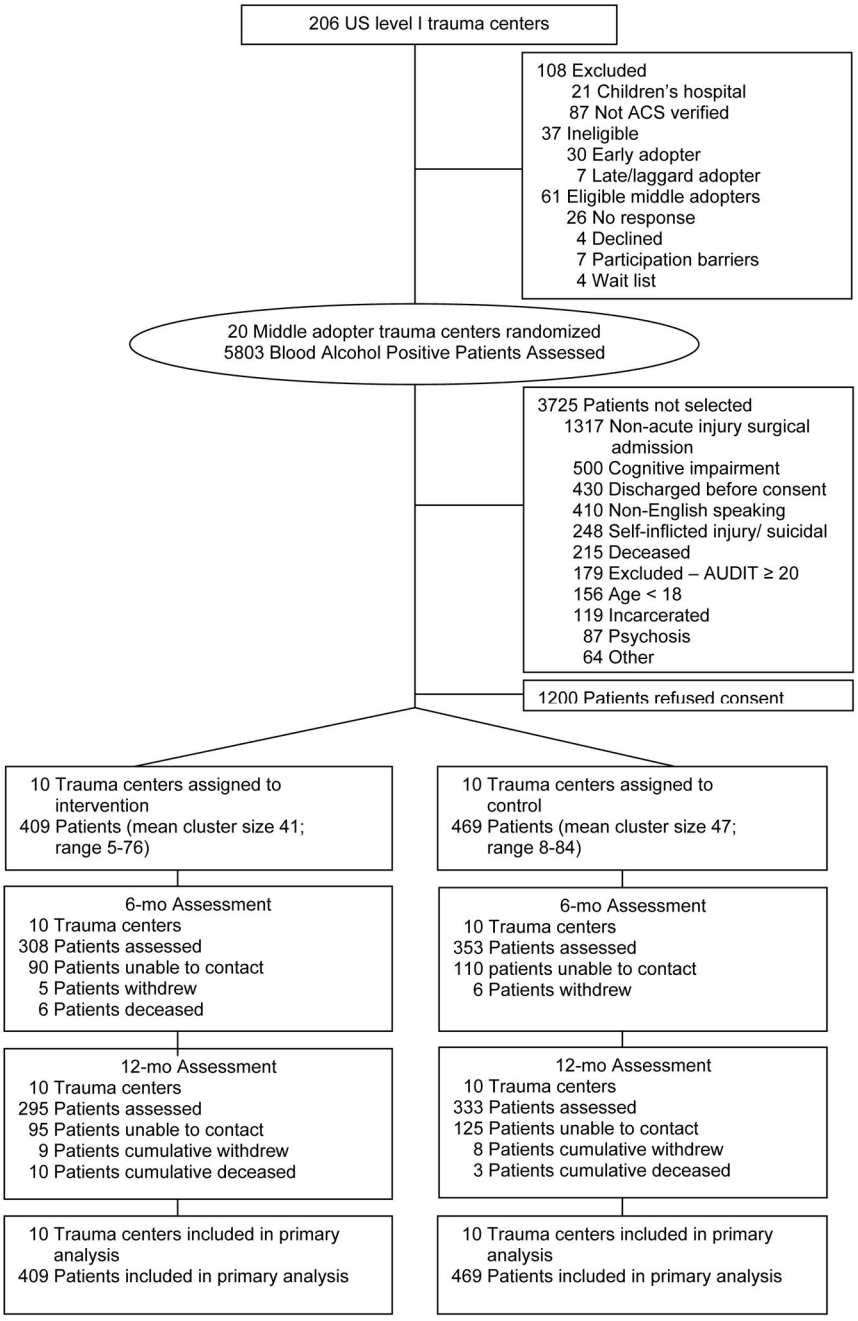

Figure 1.
Flow of clusters (trauma centers) and participants (patients) through the trial

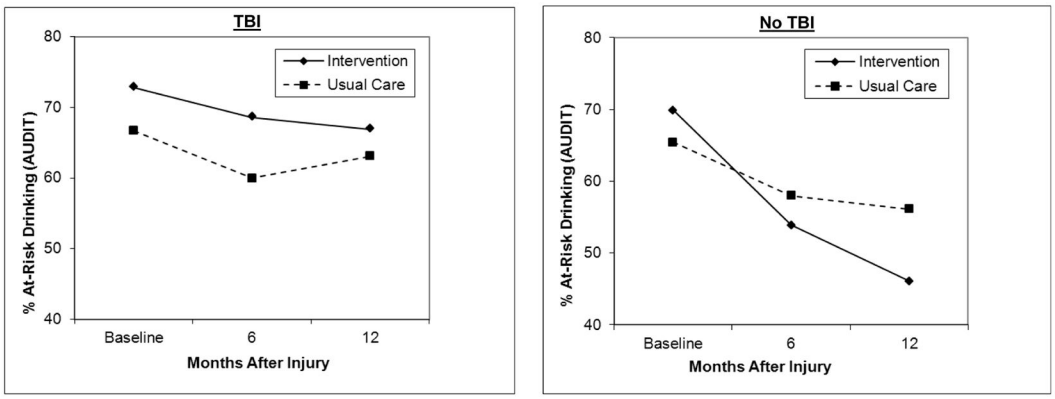

Figure 2.

At-risk drinking by treatment group among patient with and without traumatic brain injury (TBI). Baseline time point assesses alcohol use problems in the 12-months prior to the index injury admission

Table 1

Characteristics of trauma centers and patients at baseline

Characteristic	All n = 20 Sites, 878 Patients	No. (%)Intervention n = 10 Sites, 409 Patients	Usual Care n = 10 Sites, 469 Patients
Trauma Centers			
Region of country			
Midwest	5 (25.0)	3 (30.0)	2 (20.0)
South	4 (20.0)	2 (20.0)	2 (20.0)
Northeast	5 (25.0)	1 (10.0)	4 (40.0)
West	6 (30.0)	4 (40.0)	2 (20.0)
Rural status	2 (10.0)	1 (10.0)	1 (10.0)
Population served			
Adult	13 (60.0)	7 (70.0)	6 (60.0)
Adult/Pediatric	7 (35.0)	3 (30.0)	4 (40.0)
Teaching hospital	20 (100)	10 (100)	10 (100)
Council of teaching hospitals	15 (75.0)	7 (70.0)	8 (80.0)
University affiliation	16 (80.0)	7 (70.0)	9 (90.0)
No. of interns/residents mean(SD)	210 (161)	221 (203)	200 (116)
No. of hospital beds mean(SD)	517 (169)	533 (190)	502 (155)
No. of injury admissions mean(SD)	2066 (888)	2129 (1095)	2018 (758)
Patients			
Age, mean(SD), y	36.9 (14.3)	37.4 (14.7)	36.4 (14.0)
Female	208 (23.7)	105 (25.7)	103 (22.0)
Race/ethnicity			
White	545 (62.1)	253 (61.8)	292 (62.2)
Black	125 (14.2)	62 (15.2)	63 (13.4)
American Indian	38 (4.3)	25 (6.1)	13 (2.8)
Asian	14 (1.6)	8 (2.0)	6 (1.3)
Hispanic	156 (17.8)	61 (14.9)	95 (20.3)
Education, mean(SD), y	12.7 (1.9)	12.8 (2.0)	12.6 (1.8)
Marital status			
Married/living with partner	229 (26.1)	113 (27.7)	116 (24.8)
Employed	532 (61.0)	257 (63.3)	275 (59.0)
Injury severity category			
0–8	283 (32.3)	128 (31.4)	155 (33.1)
9–15	346 (39.4)	155 (38.0)	191 (40.7)
≥ 16	248 (28.3)	125 (30.6)	123 (26.2)
Traumatic brain injury			
None	437 (49.7)	196 (47.9)	241(51.4)
Yes	441 (50.3)	213 (52.1)	228 (48.6)
Intentional injury	180 (20.6)	82 (20.1)	98 (21.0)
Intensive care unit			

Characteristic	All n = 20 Sites, 878 Patients	No. (%)Intervention n = 10 Sites, 409 Patients	Usual Care n = 10 Sites, 469 Patients
No	509 (58.0)	228 (55.8)	281 (59.9)
Yes	293 (33.4)	135 (33.0)	158 (33.7)
Unknown	76 (8.6)	46 (11.2)	30 (6.4)
Days in hospital, mean (SD)	6.1 (7.7)	6.3 (7.9)	5.9 (7.5)

Table 2

Provider motivational interviewing skills over time (N = 30)

MITI Domain[a]	% Open ended questions Mean(SD)	% Complex reflections Mean(SD)	Reflection/question ratio Mean(SD)	% MI adherence Mean(SD)	Global MI spirit Mean(SD)
Baseline: Assessment 1					
Usual Care	17.9 (9.9)	9.0 (12.1)	0.29 (0.12)	37.5 (41.1)	2.6 (0.9)
Intervention	14.9 (7.2)	8.2 (12.9)	0.33 (0.19)	18.1 (27.7)	2.9 (0.8)
Follow-up Assessments 2					
Usual Care	17.1 (9.2)	12.1 (9.1)	0.39 (0.22)	35.4 (38.7)	3.0 (0.8)
Intervention	31.3 (12.2)	21.0 (13.6)	0.63 (0.25)	75.0 (36.3)	3.9 (0.4)
Follow-up Assessments 3					
Usual Care	14.5 (6.1)	6.1 (9.1)	0.32 (0.20)	20.7 (30.1)	2.4 (0.8)
Intervention	29.8 (12.7)	18.3 (11.1)	0.70 (0.39)	77.7 (30.0)	3.7 (1.0)
Follow-up Assessments 4					
Usual Care	16.1 (5.8)	4.0 (4.5)	0.31 (0.17)	35.3 (39.3)	2.5 (0.8)
Intervention	25.1 (11.1)	13.2 (12.7)	0.74 (0.35)	90.4 (22.0)	4.1 (0.8)
Follow-up Assessments 5					
Usual Care	15.6 (9.7)	13.7 (17.9)	0.29 (0.20)	33.0 (38.3)	2.7 (1.1)
Intervention	31.2 (14.1)	28.1 (16.8)	0.75 (0.40)	75.5 (25.4)	4.1 (0.4)
Follow-up Assessments 6					
Usual Care	13.9 (7.0)	1.9 (3.7)	0.32 (0.15)	36.0 (33.6)	2.6 (0.8)
Intervention	29.7 (14.1)	9.4 (9.4)	0.54 (0.28)	58.8 (42.1)	3.5 (0.9)
Follow-up Assessments 7					
Usual Care	12.8 (5.0)	1.8 (4.4)	0.31 (0.10)	34.9 (40.2)	2.9 (0.9)
Intervention	26.0 (11.0)	2.7 (5.6)	0.60 (0.23)	81.8 (31.8)	3.9 (0.6)
Change Baseline to Final Follow-up Assessment					
Usual Care	−5.2 (9.0)	−4.9 (10.6)	−0.01 (0.14)	−8.8 (34.8)	0.1 (1.1)
Intervention	14.9 (16.3)***	−2.0 (19.4)	0.29 (0.26)**	60.8 (34.6)***	0.9 (0.8)*

Abbreviations: MI, motivational interviewing; MITI, motivational interviewing treatment integrity scale.

[a]Higher scores represent greater MI skills

*p<0.05,

** p<0.01,

*** p<0.001

Table 3

Patient alcohol consumption and related alcohol use problems over time (N = 878)

				Change Baseline to 6-Month		Change Baseline to 12-Month	
Assessment	**Baseline**	**6-Month**	**12-Month**	**Change Mean(95% CI)**	**Net Diff Mean(95% CI)**	**Change Mean(95% CI)**	**Net Diff Mean(95% CI)**
AUDIT hazardous drinking, %				RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)
Usual Care	66.0	59.0	59.6	0.89 (0.87, 0.92)[c]	reference	0.90 (0.84, 0.97)[c]	reference
Intervention group	71.4	61.7	56.9	0.86 (0.79, 0.95)[c]	0.97 (0.88, 1.07)	0.80 (0.74, 0.86)[c]	0.88 (0.79, 0.98)[b]
AUDIT continuous, mean							
Usual Care	9.7	8.5	8.5	−1.2 (−1.8, −0.7)[c]	reference	−1.2 (−1.8, −0.5)[c]	reference
Intervention group	10.5	8.8	8.2	−1.8 (−2.4, −1.1)[c]	−0.5 (−1.4, 0.3)	−2.4 (−3.0, −1.7)[c]	−1.2 (−2.1, −0.3)[c]
						Change 6-Month to 12-Month	
						Change Mean (95% CI)	*Net Diff Mean (95% CI)*
Form 90 abstinent days[a], mean							
Usual Care	NA	73.4	71.3	NA	NA	−2.1 (−4.1, −0.03)[b]	reference
Intervention group	NA	74.2	75.5	NA	NA	1.3 (−0.8, 3.5)	3.4 (0.4, 6.4)[b]
Form 90 binge days[a], mean							
Usual Care	NA	10.6	11.4	NA	NA	0.7 (−1.1, 2.5)	reference
Intervention group	NA	9.4	9.4	NA	NA	0.03 (−1.9, 1.9)	−0.7 (−3.3, 1.9)
SIP total score[a], mean							
Usual Care	NA	3.38	3.08	NA	NA	−0.30 (−0.99, 0.39)	reference
Intervention group	NA	3.30	2.99	NA	NA	−0.31 (−1.04, 0.42)	−0.01 (−1.02, 0.99)

Abbreviations: AUDIT, Alcohol Use Disorders Identification Test; CI, confidence interval; NA, not applicable; RR, relative risk; SIP, Short Inventory of Problems Hazardous Drinking = AUDIT score ≥ 8 for men and ≥ 5 for women; Binge drinking days ≥ 5 drinks for men and ≥ 4 drinks for women

[a] Adjusted for Baseline AUDIT scores

[b] P<0.05

[c] P<0.01

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