Published in final edited form as:

Inj Prev. 2016 June ; 22(3): 221–225. doi:10.1136/injuryprev-2015-041596.

EFFECTS OF BRIEF INTERVENTION ON SUBGROUPS OF INJURED PATIENTS WHO DRINK AT RISK LEVELS

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Abstract

Introduction—Alcohol-related injuries are a major source of admission for trauma care.

Screening and brief intervention (SBI) for injured patients can result in decreased drinking and risk behaviors. It is not clear SBI is equally beneficial for all injured patients.

Methods—A secondary data analysis of 553 patients admitted to two Level-1 trauma centers was conducted. Latent class analysis was used to identify patient subgroups based on injury-related risks and consequences of alcohol use. Intervention effects on drinking were examined among subgroups.

Results—Five subgroups were identified. Drinking improved in patients reporting multiple risks and injuries/accidents and drinking and driving. Patients that reported drinking and driving and taking foolish risks or fighting while drinking and taking foolish risks did not show improvements.

Conclusions—Trauma centers may benefit from targeting interventions based on injury-related risks and consequences of alcohol use. Further research is needed to test bedside approaches for tailored interventions.

Keywords

Traumatic injury; risk level alcohol use; patient identification

BACKGROUND

Alcohol related injuries are a major source of admission for trauma care. Between 1996 and 2007, one out of every three (32.5%) trauma center visits was by patients who had a positive alcohol test, with specific rates ranging from 26–63%. [1] Screening and brief intervention (SBI) has demonstrated important improvements for alcohol consumption and related risk behaviors; [2] however, it is not clear from the current literature that SBI is equally beneficial for all injured patient populations. [2–3] Knowing which subgroups of injured patients are most responsive to SBI can enable clinicians to tailor services to meet individual patient need and enhance outcomes. [4]

Our recent exploratory research used latent class analysis (LCA) to identify subgroups of patients based on self-reported injury-related risks and consequences of alcohol use. We found differential levels of drinking improvement among five distinct subgroups. [5–6] A primary limitation of these previous analyses is we only examined drinking outcomes among participant subgroups randomized to brief intervention conditions and not controls. While we were able to identify improvements among participants who received interventions, we were unable to identify if these changes were a result of the interventions or effects of other influences.

Current Study

The current study reports the results of a secondary data analysis from a recently completed but similar SBI randomized clinical trial. Based on our previous findings, we hypothesized a five subgroup solution would best fit the data, and brief intervention would produce significant improvements in alcohol use among participant subgroups characterized by: (a) reports of *accidents and injuries* to self and (b) *multiple injury-related risks and consequences* of alcohol use. [5–6]

METHODS

Participants and Design

Data for this secondary analysis were collected as part of a multisite randomized clinical trial that examined the effects of SBI on reducing alcohol use among patients that reported a pattern of at-risk drinking, drank within six hours of their current injury, or had a positive blood alcohol draw (Clinical trials registry: NCT00428181). Screening methods, patient recruitment, study design and intervention, and rates of follow up have been reported in detail previously. [7] Patients who agreed to participate completed a baseline assessment that captured socio-demographics, alcohol use severity, and injury-related risk behavior. Patients were randomized to one of three intervention conditions: brief advice (BA, n=193), brief motivational intervention (BMI, n=189), or brief motivational intervention plus a 30-day booster telephone call (BMIB, n=171). Follow-up assessments were conducted at three, six, and 12 months post-discharge, and follow-up rates ranged from 85–75%. The main outcomes of the study demonstrated significant improvements for alcohol consumption among patients who received BMIB. [7]

Assessment and Measurement

Participant alcohol consumption patterns were captured using the Timeline Follow Back method.[8] For the current study, four alcohol use outcomes were calculated: average standard drinks [9] consumed per week, percent days abstinent, percent days heavy drinking, [10] and maximum number of drinks consumed on one occasion. The natural log of average drinks, percent days heavy drinking, and maximum consumed were calculated to normalize distributions.

Eight indicators were selected from the Short Inventory of Problems+6 (SIP+6) [7 11] based on their previously demonstrated relationship with individuals seeking emergency and trauma care [12–14] and our previous work of identifying injured patient profiles associated with alcohol use.[5 6] These items include: (1) Having driven a motor vehicle after having three or more drinks; (2) having taken foolish risks while drinking; (3) having gotten into a physical fight while drinking; (4) having been arrested for driving under the influence of alcohol; (5) having had trouble with the law (other than driving while intoxicated) because of drinking; (6) having had an accident while drinking or intoxicated; (7), having been physically hurt, injured, or burned while drinking or intoxicated, and (8) having injured someone else while drinking or intoxicated. A unique addition to our current model compared to our previous models is the inclusion of the “trouble with law” indicator. This addition was based on the demonstrated relationships in the literature between drinking, injury, and legal involvement. [15 16]

Analyses

The purpose of the current study was to identify subgroups of participants based on injury-related risks and consequences of alcohol use measured at baseline using the eight SIP+6 items. A latent class analysis (LCA) was performed using the Akaike Information Criterion (AIC), Adjusted Bayesian Information Criterion (ABIC), and Bootstrapped Likelihood Ratio Test (BLRT) to identify the optimal number of subgroups of patients. Subgroups are identified in an iterative fashion, estimating a two-group solution, three-group, and so on until the optimal number of classes is identified using the fit criteria and ratio test. A common convention for latent variable modeling suggests roughly five to ten cases per parameter estimated in order to adequately power analyses.[17] LCA estimation was conducted using Mplus 7.11.[18]

Patient subgroup assignment was used to estimate intervention effects on drinking outcomes. This “classify and analyze” approach is the recommended method for estimating treatment effects among latent classes on continuous outcomes.[19] We used a mixed effects model framework with maximum likelihood estimation. We employed an autoregressive residuals (AR1) structure to account for repeated observations across time. Dependent variables were average standard drinks consumed per week, percent days abstinent, percent days heavy drinking, and maximum number of drinks consumed on one occasion. Fixed effects included time and the intervention conditions as primary predictors. Time-by-intervention interactions terms were also assessed to examine the effects of treatment across time. Models were also adjusted for patient demographics and health behaviors (Tables 2 and 3 footnotes).

Participant was modeled as the random effect. Mixed effects models were estimated using Stata 13.1.[20]

RESULTS

Participants (N=553, Table1) were mostly male (78%), white (41.4%), and employed (59%), with nearly half having completed high school or more education (46%). More than half (54%) had received medical treatment for a previous injury, and about a quarter of current injuries were intentional (26%). Participants reported consuming an average of 19 drinks per week (SD=31), with an average maximum of 13 drinks on one occasion (SD=10.6).

Five subgroups (Figure 1) were identified in the current analyses as best fitting the data (AIC= 3939.2, ABIC= 3989.4, BLRT=0.00). This five subgroup solution estimated 44 parameters, thus having adequate numbers of cases per parameter (553 participants/44 parameters estimated). Overall model entropy was 0.72. The average latent class probability for subgroup membership ranged from 0.71–0.86. Subgroups were named using key discriminating subgroup features. These names are simply labels and are not intended to be absolutely definitive. Details of what constitutes each of the identified subgroups can be viewed in Figure 1, which displays the conditional item probabilities for participants in each group having endorsed the specific items from the SIP+6. This is to say, Figure 1 shows how likely subgroup members were to have said they had engaged in the stated behavior or had the experience.

The *multiple risks* subgroup (n= 53, 9.6%) had a higher probability of item endorsement on five of the eight SIP+6 items compared to the four other subgroups. The *fighting and foolish risk* subgroup (n=45, 8.1%) had a 100% probability for fighting while drinking and an approximately 68% probability of reporting taking fooling risks while drinking. The *drinking and driving/foolish risk* subgroup (n=122, 22.1%) had a more than 70% probability of reporting drinking and driving and a nearly 60% probability of reporting foolish risk taking while drinking. All members of the *injuries/accidents drinking and driving* subgroup (n=84, 15.2%) endorsed injuring themselves while drinking, a nearly 70% probability for drinking and driving, and a more than a 50% probability for having accidents. The *minimal risks* subgroup (n=249, 45%) had the lowest probabilities of item endorsement compared to all other subgroups.

Outcome Analyses

The *injuries/accidents drinking and driving* subgroup's baseline average drinks per week were 17.2 (SD=16.8), with a maximum amount consumed of 12.8 drinks (SD=7.5). This group also had an average of 63% (SD=0.31) days abstinent and 25% (SD=0.26) days heavy drinking. Participants in this group who received BMIB showed significant decreases in average drinks per week and maximum amount consumed on one occasion at six months post-discharge and significant increases in percent days abstinent at six and 12 months (Table 2). Members of this subgroup who received BMI experienced a significant decrease in percent days heavy drinking at three months.

Participants within the *multiple risks* subgroup's baseline average drinks per week were 36.6 (SD=50.7), with a maximum amount consumed of 20.5 drinks (SD=15.7). This group also had an average of 57.6% (SD=0.30) days abstinent and 37.2% (SD=0.30) days heavy drinking. Participants in this group that received BMIB experienced significant reductions in average drinks per week at three and 12 months and maximum amount consumed at 12 months (Table 3). Members of this subgroup that received BMIB also experienced significant increases in days abstinent at three and 12 months.

Participants in the *minimal risk* subgroup who received a BMIB significantly reduced their maximum amount consumed at three months post discharge ($B = -0.20$, $SE = 0.08$, $p = 0.014$). Patients that reported *drinking and driving and taking foolish risks* or *fighting while drinking and taking foolish risks* did not show significant improvements (results not shown).

DISCUSSION

Results of this secondary data analysis show there were five subgroups of individuals that consumed alcohol at risk levels, experienced injury, and were admitted for trauma care; these results are similar to those previously reported.[5 6] Patients that received BMIB and were characterized by *injuries/accidents and drinking and driving* and *multiple risks* experienced the most consistent improvements in drinking. For these patients, BMIB appears to be a valuable approach for reducing alcohol use and maximum amount consumed on one occasion following discharge. Furthermore, compared to previous studies of brief interventions delivered to trauma/emergency department patients, patients who reported the most alcohol-related problems in our study, the *multiple risks* group, experienced some of the largest alcohol use improvements, average drinks and days abstinent, at 12 months post-intervention. [12] However, also similar to previous studies, participants in the current study appear to have limited reductions in heavy drinking. [21]

Subgroups comprised of individuals who reported *drinking and driving and taking foolish risks* and those that reported *fighting while drinking and taking foolish risks* showed no significant improvements. These findings provide support that Level-1 trauma centers may benefit from triaging patients to tailored brief interventions based on injury-related risks and consequences of alcohol use. These findings are similar to those previously reported from our intervention group only LCA models.[5 6] Tailored brief interventions must be developed, tested, and possibly implemented for these patients.

To advance the field through application of patient classification within a trauma setting, prospective research should be conducted to identify methods to pilot-test bedside programs wherein patients can be interviewed regarding their past injury-related risks and consequences of alcohol use. Results from such interviews could be uploaded and aggregated into larger databases containing responses from previously collected patient populations in order to run classification algorithms and draw out profile assignments. With this information, providers could better select appropriate interventions for individual patients. Such an approach could be easily tested, and if efficacious and effective, implemented into models of care.

Limitations

Three primary limitations should be taken into account when considering these findings. First, the analyses conducted for this study were conducted in two steps: the estimation of latent classes and subsequent development of mixed effects models to test intervention effects on drinking among subgroups. Subgroup assignment based on posterior probability was exported and used to enumerate the subgroups of patients for mixed effects models, a method that inherently models subgroup assignments based on probability. Although probabilistic class assignment carries with it a chance of misclassification, the “classify and analyze” approach is the currently recommended procedure within the field for estimating intervention effects among latent classes for continuous outcomes.[19] However, based on our average latent class probability for most likely subgroup membership, we have confidence participants are accurately classified. Second, the parent study upon which the current analyses are based was not designed to evaluate the current hypotheses. Therefore, prospectively recruiting patients in future research for the purposes of classification and for tailored intervention delivery could improve data quality. Lastly, this study does not examine the influence these brief alcohol interventions on injury outcomes. Such knowledge would provide great benefit to the field, and subsequent research should address this question.

CONCLUSION

Heavy alcohol use is the major contributor to injury in the US resulting in trauma care. SBI is an evidence-based behavioral health service shown to reduce alcohol use and injury-related risk behaviors. Understanding which injured patient subpopulations benefit the most from SBI is critical to maximizing intervention outcomes.

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What is already known on this subject

- Evidence for the effectiveness of brief alcohol interventions for injured patients is inconsistent.
- A number of subgroups of injured patients respond to brief alcohol interventions.

What this study adds

- This study shows five subgroups of injured patients exist based on injury-related consequences of alcohol use.
- Patients within the (a) multiple risks and (b) injuries/accidents and drinking and driving groups experience the greatest drinking improvements following brief alcohol intervention.

Figure 1. depicts the conditional item probabilities of the five subgroup solution, the labels for each group, and the number and portion of the patients within each.

Table 1

Baseline characteristics of study participants (N=553)

Variable	%
Male	77.8
Age ^a	34.9 (12.5)
Race	
White	41.4
Black	25.1
Hispanic	28.4
Employed	59.1
Education level	
High school	45.8
Previous injury treatment	54.1
Current injury intentional	26.0
Baseline alcohol severity and use ^a	
Audit C	4.9 (3.2)
Average drinks per week	18.5 (31)
Percent days abstinent	66% (0.3)
Percent days heavy drinking	22% (0.27)
Max consumed	13.1 (10.6)

^aMean and SD

Table. 2Drinking outcomes for injury/accident drinking and driving subgroup^a

Drinking outcome	3 months		6 months		12 months	
	B (SE)	p	B (SE)	p	B (SE)	p
Average drinks per week						
BMI × Time	0.13 (0.13)	0.286	−0.11 (0.16)	0.481	−0.12 (0.17)	0.468
BMIB × Time	−0.22 (0.15)	0.145	−0.70 (0.16)	<0.001	−0.39 (0.21)	0.064
Percent days abstinent						
BMI × Time	−0.08 (0.08)	0.280	0.04 (0.08)	0.634	0.13 (0.09)	0.127
BMIB × Time	0.05 (0.09)	0.541	0.31 (0.10)	0.003	0.25 (0.11)	0.023
Percent days heavy drinking						
BMI × Time	−1.4 (0.52)	0.007	−0.52 (0.55)	0.338	−0.78 (0.54)	0.152
BMIB × Time	−1.15 (0.60)	0.055	0.02 (0.65)	0.975	−0.92 (0.69)	0.179
Maximum amount consumed						
BMI × Time	0.22 (0.12)	0.053	0.03 (0.14)	0.833	0.03 (0.14)	0.837
BMIB × Time	0.01 (0.14)	0.960	−0.41 (0.16)	0.011	−0.06 (0.18)	0.743

^a Adjusted for: study site, baseline individual alcohol use severity (AUDIT-C), drinking at the time of the current injury, previous injury treatment, intentional/unintentional current injury, race, gender, age, work status, and education level.

Table. 3Drinking outcomes for multiple risk subgroup^a

Drinking outcome	3 months			6 months			12 months		
	B (SE)	p		B (SE)	p		B (SE)	p	
Average drinks per week									
BMI × Time	0.11 (0.19)	0.568		0.04 (0.22)	0.861		-0.37 (0.24)	0.120	
BMIB × Time	-0.56 (0.19)	0.003		-0.29 (0.22)	0.188		-0.88 (0.24)	<0.001	
Percent days abstinent									
BMI × Time	-0.11 (0.10)	0.272		-0.01 (0.11)	0.946		0.05 (0.13)	0.675	
BMIB × Time	0.22 (0.10)	0.031		0.22 (0.12)	0.060		0.41 (0.12)	0.001	
Percent days heavy drinking									
BMI × Time	0.34 (.56)	0.537		-0.50 (0.58)	0.394		-0.54 (0.61)	0.378	
BMIB × Time	-0.59 (0.57)	0.301		-0.43 (0.60)	0.470		-0.80 (0.60)	0.186	
Maximum amount consumed									
BMI × Time	0.05 (0.16)	0.740		0.19 (0.19)	0.315		-0.22 (0.21)	0.297	
BMIB × Time	-0.30 (0.16)	0.064		-0.17 (0.19)	0.384		-0.55 (0.21)	0.008	

^a Adjusted for: study site, baseline individual alcohol use severity (AUDIT-C), drinking at the time of the current injury, previous injury treatment, intentional/unintentional current injury, race, gender, age, work status, and education level.