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Injury-Related Consequences of Alcohol Misuse among Injured Patients Who Received SBI for Alcohol: A Latent Class Analysis

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Abstract

Background—Screening and brief alcohol intervention has demonstrated efficacy in improving drinking and other risk behaviors for some patient populations. However, it is not clear that brief interventions are helpful to all injured patients who drink at risk levels. This paper identifies latent classes of intervention recipients based on injury-related consequences and risks of alcohol misuse and then determines which profiles experienced the greatest improvements in drinking.

Methods—A secondary analysis was conducted using data from injured patients (N=737) who reported heavy drinking and received a brief alcohol intervention in a Level-1 trauma center. Latent class analysis was used to determine patient profiles, and seven indicators commonly associated with alcohol-related injury from the Short Inventory of Problems+6 were used to determine the latent class measurement model. Covariates were regressed onto the model to assess factors related to class membership, and drinking outcomes were analyzed to examine improvements in drinking.

Results—Five classes emerged from the data. The classes that reported the greatest improvements in drinking following discharge were those characterized by multiple alcohol-related risks and those characterized by a history of alcohol-related accidents and injuries. Attributing the current injury to drinking was a significant predictor of class membership among those classes that reported higher levels of improvement.

Conclusions—This study provides tentative evidence that subclasses exist among heavy drinking injured patients who received a brief intervention in a Level-1 trauma center, and some

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Author Contributions

Gerald Cochran conceptualized this project, carried out the analyses, and wrote the manuscript. Craig Field provided guidance in conceptualizing the project and provided critical feedback on the analyses and manuscript. Dr. Field was also a Co-Investigator on the parent clinical trial. Raul Caetano provided critical feedback on the manuscript and was the Principal Investigator on the parent clinical trial.

subclasses experience greater drinking improvements than others. Further research is required to substantiate the findings of this secondary analysis.

Keywords

Screening and brief intervention; alcohol-related injury; and latent class analysis

INTRODUCTION

Alcohol Misuse and Injury

Heavy drinking is the primary risk factor for injury in the United States.¹ Approximately 40 to 50 percent^{2–4} of patients admitted to Level-1 trauma centers are intoxicated. Once discharged, patients who suffered traumatic injuries often experience re-injury,^{5–7} with a rate of up to 44 percent.⁷ Motor vehicle crashes are a major source of alcohol-related injury among patients admitted to trauma centers,⁸ with nearly one-third of all alcohol-related motor vehicle crashes resulting in injury.⁹ Alcohol-related violence is also a leading cause of injury treatment in emergency^{10,11} and trauma settings.^{12,13} Violent offenses, such as assault and sexual assault, are often perpetrated by individuals who have been drinking or perpetrated on individuals who have been drinking.^{14–16}

Addressing Alcohol-Related Injury

Screening and brief intervention has been identified as an important tool to help injured patients who drink at risk levels. Results of screening and brief intervention (SBI) studies for injured patients assessed as at-risk alcohol users and/or those who were drinking at the time of their injury have demonstrated a number of positive outcomes.^{2,17–21} Conversely, a number of randomized clinical trials with injured individuals assessed as at-risk alcohol users and/or those who were drinking at the time of their injury have failed to demonstrate positive outcomes for brief intervention recipients.^{22–25} Because of these mixed findings, researchers have sought to understand which subgroups of study participants could be responding to SBIs. For instance, Field and colleagues²⁶ found that Hispanics had better drinking outcomes than other races/ethnicities following a brief intervention. Gentilello et al.² found that male injury patients responded better to a brief intervention delivered in a trauma center than female patients. Mello and colleagues²⁷ have reported that patients injured in a motor vehicle crash responded more favorably to a brief intervention than did patients who experienced non-motor vehicle crash injuries. Watt et al.²⁸ showed that individuals involved in violent offenses who received a brief alcohol intervention reported significant reductions in subsequent injuries. Researchers have also found that causal attribution (attribution of the injury to drinking) significantly influences study outcomes.^{29,30} That is, brief interventions have been more efficacious in reducing drinking over time for those persons who believed their drinking was the cause of their accident. Collectively, these studies provide insight into the types of patients making the greatest improvements following the receipt of SBI.

Study Purpose

The purpose of this secondary analysis is to identify whether there are subclasses of injured patients who received a brief alcohol intervention in a Level-1 trauma center. The purpose of this analysis also is to describe whether the identified classes have greater or lesser changes in alcohol use following admission, intervention, and discharge. The importance of answering this question is based in the fact that it is clear from the literature that specific behaviors (such as drinking at risk levels, drinking and driving, and alcohol-related violence) often precede injury. It is also apparent from the literature that there are individual level indicators that are associated with injury care and subsequent change following receipt of SBI. However, what is not clear is how these behaviors and individual level indicators converge to form behavioral profiles and what drinking improvements may be associated with those profiles. Latent class analysis (LCA) was used to identify probabilistic patient profiles or “classes” based on past injury-related consequences and risks of alcohol misuse. The measure used in the current study to capture the combined alcohol use, consequences, and risk behaviors was the Short Inventory of Problems (SIP)+6.^{31–34} The strength of this instrument is its ability to capture both alcohol misuse and consequences as they pertain to seeking injury care. In addition to the SIP+6, demographic characteristics, history of injury care, and patient beliefs about the relation of their alcohol use and the injury event were also used to determine individuals’ membership in the defined classes. Benefit following the brief intervention and discharge was measured by determining which subgroups experienced the greatest reductions in post-intervention alcohol use. Unlike traditional multivariate prediction models, a LCA latent variable approach better depicts the complexity of alcohol related injury through the identification of patient profiles and individual influences on membership in those profiles.

The current study explores the behavioral profiles of injured patients who are most likely to benefit from brief intervention. These findings extend our current understanding of the subgroups of patients who are more likely to evidence differential change. Future research will need to further explore why particular subgroups of patients are more likely to benefit from brief interventions in various medical settings.³⁵

METHODS

Study Sample

Data from a SBI clinical trial conducted in a Level-1 trauma department was used in this analysis (P.I.: Caetano, R., NIAAA, R01 013824). Details of the consort chart, methods of participant recruitment, and description of treatment conditions for this trial have been reported previously.^{26,36–38} Participants were not screened for the study if they were less than 18 years of age, spoke languages other than English or Spanish, or had insufficient contact information to allow for follow up assessment. Patients were also not screened if they were under arrest or in police custody, were actively suicidal or psychotic, were victims of sexual assault, or had a medical condition that prevented a face-to-face interview (such as severe head or neck trauma). Furthermore, cognitively disoriented were assessed by staff to evaluate eligibility for recruitment.

Patients were recruited in the study if they: (1) were intoxicated upon admission to the trauma center or reported drinking six hours before the injury event (but patients who were intoxicated at the time of their admission were monitored and considered eligible to participate once evidence of acute intoxication had resolved), (2) reported drinking at or above NIAAA risk levels (i.e., men: 5 drinks/day or 15 drinks/week; women: 4 drinks/day or 8 drinks/week),³⁹ or (3) responded positively on one or more items of the CAGE.^{38,40–42} Eligible patients provided signed informed consent to participate in the study. Study participants were randomized into one of two conditions: treatment as usual (TAU) or brief motivational intervention (BMI). Participants in both conditions were assessed for demographics, substance use, and injury-related risk behaviors at baseline, six, and 12 months. This dataset contains baseline, six-, and 12-month alcohol use and alcohol risk information (N=1,493) for patients admitted for care.

The main outcomes from the original trial found significant reductions in alcohol use among Hispanic participants compared to others³⁶ and for those who were alcohol dependent compared to those who were not dependent.²⁶ The application of mixture modeling to SBI outcomes is new within the field, and the application of mixture modeling to clinical trials is also an emerging approach. Therefore, data from the experimental group only (n=737) were used to conduct the present study in order to lay the groundwork for further mixture analyses of SBI clinical trial data.

Measures

Measurement model—Table 1 lists all of the items used in this analysis, item coding, and the time periods which the items represent. The variables selected for inclusion in the LCA measurement model in the present study were items from the SIP +6. The SIP+6 is a 20 item measure that assesses risks and consequences of alcohol use.³³ This measure is derived from the Short Inventory of Problems³¹ and the Drinker Inventory of Consequences (DrInC-2L).³² The seven items selected from the SIP+6 are the injury-related consequences of alcohol misuse that have been identified and established in the literature as the specific factors that result in individuals to receiving emergency and trauma care (e.g. drinking and driving, fighting while drinking, having an accident while drinking or intoxicated, etc.).^{2,13,33,34,43–45}

Covariates—The covariates selected for inclusion in this LCA model are also factors that have emerged from the literature; including demographic traits,^{2,26} beliefs about drinking and the current injury (i.e. causal attribution),^{29,30} and injury treatment history^{5–7,46}; that have been found to be characteristic of those who seek care for alcohol-related injuries and have made positive changes in alcohol use following the receipt of brief interventions.

Distal outcomes—Participant improvement following the intervention and discharge was measured using multiple self-report measures of alcohol use. A standard drink for this project was measured as 12 ounces of beer, five ounces of wine, or 1.5 ounces of distilled spirits.⁴⁷ Distal drinking outcome variables were calculated for the baseline, six-, and 12-month follow ups based on quantity and frequency questions used in previous US National

Alcohol Surveys^{48,49}. The following methods for calculating the drinking outcomes have been reported previously.^{26,36,50–52}

Percent days abstinent (PDA) estimations were based on individual participants' frequency of drinking for the previous 12 months at baseline or for the previous six months at the six and 12 month follow up assessments. Percent days heavy drinking (PDHD) were calculated by dividing: (1) the frequency of having five or more drinks per drinking occasion for the previous 12 months at baseline or for the previous six months at the six and 12 month follow up assessments by (2) participants' drinking frequency for the previous 12 months at baseline or for the previous six months at the six and 12 month follow up assessments. Maximum amount consumed in one day was measured as a single item asked of all participants for the previous 12 months at baseline or for the previous six months at the six and 12 month follow up assessments.

Analyses

LCA was selected as the statistical method for this project because it allowed for the identification of subgroups of individuals⁵³ using a subset of injury-related consequences and risks of alcohol misuse items. The Akaike Information Criterion (AIC), Adjusted Bayesian Information Criterion (Adjusted BIC), the Lo-Mendell-Rubin Adjusted Likelihood Ratio Test (LMR), and Bootstrapped Likelihood Ratio Test (BLRT)^{53–55} were used to establish the LCA solution with the optimal number of classes. The lowest values of the AIC and adjusted BIC were used to indicate the optimum number of classes within the model.⁵⁴ One class minus a non-significant LMR and BLRT value was used in combination with the AIC and adjusted BIC to substantiate the number of classes in the model. Quality of classification was examined to support the accuracy of classification for subgroups identified using Entropy and the Average Latent Class Probabilities for Most Likely Class Membership, with the Average Latent Class Probabilities providing the most accurate depiction of accuracy of individual class assignment (B. Muthen, personal communication, Mplus discussion board, March 17, 2011). Mplus 6⁵⁶ was used to carry out the LCA. Furthermore, in addition to class selection based on fit criteria and ratio tests, the identified classes were evaluated for their clinical utility and conceptual clarity.

Additional influences on class membership were estimated by adding demographic characteristics, causal attribution, and previous injury medical care as covariates to the model. The covariate effects were estimated using the pseudo class logistic regression method within Mplus.^{53,57–60} Specifically, the latent class model was estimated then the covariates were added. Further, to examine drinking outcomes at the six- and 12-month follow ups for individuals' classes, distal outcomes were also estimated.⁵⁸ A one-way ANOVA was conducted to examine between class differences in drinking at baseline. Repeated measures ANOVAs were also conducted to examine within class mean differences for the drinking outcomes based on class assignment from baseline to six and 12 months. Specifically, class membership based on highest posterior probabilities were exported from Mplus and used in within IBM SPSS 20⁶¹ to assess differences in drinking for the identified subclasses. Finally, Cohen's d ⁶² statistics were calculated to examine the magnitude of the effect sizes between means at follow up time points.

RESULTS

Table 2 contains participant demographics and aggregate baseline alcohol use levels. Approximately 86% of participants were male with a mean age of 33 years. Whites represented 44 percent of the sample, followed by 36 percent Hispanics and 20 percent Blacks. More than one-third of participants (37.7%) had a high school diploma or GED (35.7%). Roughly 80 percent of participants had experienced unintentional injury.

Using the seven indicators of injury-related consequences of alcohol misuse selected for the LCA model, a five class solution was identified (see Table 3). This model was based on the lowest values of the AIC (4950.12) and adjusted BIC (5005.78) along with one class minus a non-significant LMR ($p=.02$) and BLRT ($p<.001$). Entropy for the latent class model was 0.74.

These five classes can be described using labels related to the key discriminating dimensions as follows (see Figure 1): (1) the *multiple risks and consequences class* ($n=134$, 18.1%) endorsed three of the seven items at rates higher than any other class, three items at the second highest levels compared to other groups, and the final item was endorsed at 100 percent (tying with the *drunken driving class* for driving after drinking). The quality of classification for this class was 0.83. (2) All members of the *drunken driving class* ($n=247$, 33.5%) had driven after having three or more drinks. The second highest item endorsement for this class was taking foolish risks (57.3%). The quality of classification for this class was 0.80. (3) All members of the *fighting and foolish risks class* ($n=24$, 3.3%) had been in a physical fight when drinking, and the second highest item endorsement for this group was taking foolish risks (62.0%). The quality of classification for this class was 0.88. (4) The *accidents and injury history class* ($n=34$; 4.6%) was composed of members who while intoxicated had most often experienced an accident (79%) and suffered an injury (83.9%). The quality of classification for this class was 0.75. (5) The *minimal risk and consequences class* ($n=298$, 40.4%) contained individuals who had taken less risk on six of the seven items compared to other classes. The quality of classification for this class was 0.87.

Table 4 reports the results of the one-way ANOVA test of differences in baseline levels of alcohol use. The multiple risks class had the lowest levels of PDA at baseline compared to the all other classes, with the exception of the *accidents and injury history class* compared to which there were no significant differences. The multiple risk class also had the significantly highest baseline value for maximum amount consumed compared to all other classes and a significantly higher PDHD compared to the minimal risks class.

Model Covariates

Covariates were added to the model (see Table 5), with the *minimal risk and consequences class* used as the reference group. The covariates of having received previous emergency or hospital care for an injury ($B=1.27$, $p<.001$, $OR=3.54$), attributing the current injury to alcohol use ($B=1.31$, $p<.001$, $OR=3.69$), and being White (i.e.: Hispanic, $B=-1.04$, $p<.001$, $OR=0.35$; Black, $B=-1.55$, $p<.001$, $OR=0.21$) and male ($B=1.27$, $p<.001$, $OR=3.55$) all significantly influenced inclusion in the *multiple risks and consequences class*. Causal attribution ($B=0.62$, $p=.01$, $OR=1.87$) and being male ($B=0.88$, $p=.01$, $OR=2.41$)

significantly influenced membership in the *drunken driving class*. For the *accidents and injury history class*, causal attribution ($B=1.86$, $p<.001$, $OR=6.41$) significantly influenced class membership.

Distal Outcomes

Percent days abstinent—The largest increase in PDA (see Table 6) for early follow up (baseline to six-months) was for the *multiple risks and consequences class*, which experienced a 16 percent increase in days abstinent. This increase was significant with a d of 0.47. The largest overall increase (baseline to 12-months) in abstinence was for the individuals in the *multiple risks and consequences class* who experienced a 17 percent increase in days abstinent. This increase was significant with a d of 0.52.

Percent days heavy drinking—The largest significant reduction in PDHD (see Table 6) for early follow up was for the *minimal risk and consequences class*, which experienced a decrease of 11 percent PDHD with a d of 0.26. The largest significant overall reduction in PDHD was for the *minimal risk and consequences class*, which experienced a 10 percent decrease with a d of 0.23.

Maximum amount consumed—The *accidents and injury history class* experienced the largest significant improvements (see Table 6) in the maximum amount consumed at the early follow up and the overall assessment periods with reductions of 7.3 and 6 drinks and d s of 1.2 and 0.97, for the respective assessment points. The *multiple risks and consequences class* also experienced reductions of 8.7 and 7.9 drinks at the early follow up and overall assessment periods. These reductions were significant with effect sizes of 0.85 at six- and 0.69 at 12-months.

DISCUSSION

This secondary analysis provides some initial insights into risk behavior profiles of patients who might be more likely to experience positive change following brief interventions or who may benefit in different ways. This analysis is unique in the respect that it considers behavioral risk factors related to drinking rather than drinking, per se. It also goes beyond our current understanding of subgroup differences in drinking outcomes, which have been examined elsewhere. Specifically, the results suggest five groups of patients with readily distinguishable behavioral profiles that tend to experience different drinking outcomes. Understanding the behavioral profiles of patients who differentially experience change following brief intervention may provide support for interventions that are targeted towards particular patient populations or interventions that are specifically tailored toward the needs of the patient. While these results are preliminary and should be replicated, they have potentially important implications for research and practice.

The five groups of patients identified may be more broadly classified in terms of the degree of change experienced following the intervention. Some groups of patients appeared to have high levels of change; while for others, drinking outcomes appeared to be impacted to a lesser or limited extent. While markedly distinct from one another, the *multiple risks and*

consequences and the *accidents and injury history classes* appear to have experienced relatively high levels of change.

The *multiple risks and consequences* group may be patients who are prone to re-injury following discharge.^{5–7,46} Members of this class seem to be most likely to make improvements in drinking compared to the other identified classes. These improvements in drinking could be related to this class's high level of drinking at baseline. However, this may not be the case for all of the outcomes observed. The *accidents and injury history class* reported stronger changes in maximum amount consumed than the *multiple risks and consequences class* despite the *accidents and injury history class's* having significantly lower baseline values for maximum amount consumed. Furthermore, the *accidents and injury history class* also appear to have made this high degree of improvement in spite of having some of the lowest baseline values for maximum amount consumed. Membership in the *accident and injury history class* was related to a history of experiencing alcohol-related accidents and injuries but not to a history of care for injuries, suggesting the previous injuries among the members of this class were less severe (did not require hospital care). Reduced drinking in this group may be attributed to a hospital admission for one of the first times in their lives for a more severe injury than they had previously experienced that they believe was caused by alcohol use—possibly equating to a teachable moment.^{63,64} Regardless of the reason for change, individuals in the *accidents and injury history class* along with the *multiple risks and consequences* group experienced significant and consistent reductions in alcohol use. Thus, changes in drinking are not necessarily related to the levels of alcohol use at baseline but may be more associated with the types of alcohol related risk behaviors in which the person engages.

Other classes identified appear to have improved to a lesser extent. The *drunken driving class* reported small to moderate changes in their alcohol use. The high levels of risks associated with drinking and driving combined with this class's relatively limited improvements in drinking suggests these patients may require more intensive services or perhaps a booster session following the brief intervention, as recommended by Longabaugh et al.¹⁹ Similar to the *drunken driving class*, improvements in the *minimal risk and consequences class* were limited based on small observed effect sizes. This group experienced among the lowest levels of change on drinking outcomes. However, this group was the only group to show reductions in heavy drinking. Given the high association of heavy drinking and injuries, brief intervention still leads to a clinically meaningful outcome for this group of patients. Because these individuals lacked histories of injury-related consequences, and their PDHD at baseline was the second lowest of all classes, perhaps members of this class are those identified in the literature as individuals who drink infrequently at high levels and experience high injury rates.^{65,66} Future research is needed to identify what could enhance change among members in this class. Barring identification of such factors, less intensive and cost-effective interventions or tailored interventions might lead to similar effects or increased benefits, respectively.

In contrast to the all other classes in this analysis, the *fighting and foolish risk class* reported no significant changes in drinking. This was the only class for which causal attribution was not significantly associated with membership (i.e., unlike the other classes, this class did not

associate their alcohol use and injury to a significant degree). Previous studies have identified causal attribution as a predictor of change among SBI services recipients.^{29,30} The decreased likelihood of change may be a result from this class of individuals failing to attribute their injury to their alcohol use. Interventions that specifically explore causal attribution and increase the patient's perception of the relationship of their alcohol use to their injury may improve outcomes. Moreover, risk behaviors of members of this class were largely limited to fighting and injuring others while drinking. Therefore, alternative interventions that target other problem behaviors, such as incorporating elements of anger management, could be equally or more beneficial to this group of patients.

There are several limitations that should be taken into account before considering the potential clinical implications of these findings. First, this is a secondary data analysis, suggesting a strong need to replicate these findings. Second, the one-way and repeated measures ANOVAs examining drinking outcomes were carried out by stratifying groups based on posterior probabilities. It is possible, therefore, that individuals' were misclassified based on these probabilistic classifications. However, the quality of classifications reported, ranging between 0.75 to 0.88, provide an indication of the level of class assignment accuracy. Third, two classes (the *accidents and injury history* and *fighting and foolish risk classes*) included less than five percent of the intervention population. Finally, these results may be limited to patients identified using similar screening methods in the trauma care setting. Despite these limitations, these findings have important clinical implications and suggest that groups of patients might be identified who respond differentially to interventions or would benefit from a more tailored intervention based on behavioral indicators identified at the time of admission. This is particularly true of the *multiple risks and consequences class* of individuals who would be relatively easy to identify given the high likelihood of prior injury-related consequences, history of injury care, acknowledging causal attribution, and being white males. If, for example, the seven items and the covariates included in this model were imbedded within an electronic patient health records, algorithmic class assignments could be generated to aid clinicians identify these patients in order to be aware of the clinical need for a SBI (e.g. Level-2 centers where brief intervention is not required⁶⁷) as well as probable prognosis following service delivery. Again, replication of these findings would confirm the validity of these classes, their association to subsequent drinking outcomes, and support possible future translational applications.

Conclusion

This study suggests that the *multiple risks and consequences* and *accidents and injury history classes* of individuals experience some of the greatest reductions in drinking following injury, SBI, and discharge, possibly despite baseline alcohol use level. This study has also shown that other classes of intervention recipients reduced their alcohol use but at lower magnitudes. Given that trauma centers often struggle with profitability,^{68–70} administrators and clinicians may conserve resources by knowing which patients benefit from SBI or might benefit from more targeted or tailored interventions. Such knowledge could be used to prioritize brief intervention services and refine their application thus maximizing the use of resources, and improve long-term patient outcomes.

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Figure 1.
Conditional item probabilities of the five class solution

Table 1

Observed indicators, covariates, and distal outcomes

Measurement model ^a from SIP+6	Coding	Time Period(s)
I have driven a motor vehicle after having three or more drinks	Dichotomous ^d	Baseline
I have taken foolish risks when I have been drinking	Dichotomous	Baseline
I have gotten into a physical fight while drinking	Dichotomous	Baseline
I have been arrested for driving under the influence of alcohol	Dichotomous	Baseline
I have had an accident while drinking or intoxicated	Dichotomous	Baseline
While drinking or intoxicated, I have been physically hurt, injured or burned	Dichotomous	Baseline
While drinking or intoxicated, I have injured someone else	Dichotomous	Baseline
Covariates		
Previous ED/hospital treatment for injury ^b	Dichotomous	Baseline
Causal attribution ^c	Dichotomous	Baseline
Male	Dichotomous	Baseline
Hispanic	Dichotomous	Baseline
Black	Dichotomous	Baseline
Distal outcomes		
Percent days heavy drinking	Continuous	Baseline, 6-, & 12-months
Percent days abstinent	Continuous	Baseline, 6-, & 12-months
Volume per week	Continuous	Baseline, 6-, & 12-months
Maximum amount consumed	Continuous	Baseline, 6-, & 12-months

^a Cronbach's α of 7 SIP+6 items = 0.74^b Previous ED/hospital treatment for injury were individual dichotomous items combined into a single dichotomous item^c Causal attribution (i.e. the association patients made between drinking and their current injury) was originally reported on a 0–10 visual analog scale, but was dichotomized (1=Yes attribution/<1=No attribution) for uniformity in interpretation with the other covariates.^d All dichotomized items were coded Yes(1)/No(0).

Table 2

Population demographics and baseline alcohol use

Characteristic		Number	%
Gender	Male	630	85.5%
	Female	107	14.5%
Race/Ethnicity	White	326	44.2%
	Hispanic	263	35.7%
	Black	148	20.1%
Education	Some High School	278	37.7%
	High School Diploma/GED	263	35.7%
	More than High School	196	26.6%
Marital Status	Married/cohabitating	214	29.0%
	Single/never married	329	44.6%
	Separated/divorced/widowed	194	26.3%
Age*		33.4	11.4
Injury Type	Intentional	155	21.0%
	Unintentional	582	79.0%
Prior Alcohol Treatment	No treatment	460	62.4%
	Yes treatment	277	37.6%
Baseline Alcohol Use*	Percent days abstinent	67%	0.3
	Percent days heavy drinking	62%	0.4
	Maximum consumed on one occasion	13.89	10.9

* Mean and standard deviation

Table 3

Numbers of classes and model selection criteria for the Tx group

Classes	AIC	Adjusted BIC	LMR	BLRT	χ^2	Entropy
2	5042.20	5063.61	0.00	0.00	216.1	0.74
3	4979.08	5011.91	0.00	0.00	136.9	0.65
4	4963.14	5007.38	0.02	0.00	105	0.71
5	4950.12	5005.78	0.02	0.00	75.9	0.74
6	4954.35	5021.43	0.34	1.00	64.2	0.74

Table 4

Baseline differences in drinking by class

Class	PDA		PDHD		Maximum Amount consumed	
	Mean	SD	Mean	SD	Mean	SD
Multiple risks and consequences	0.51 ^a	0.3	0.71 ^e	0.4	20.55 ^g	14.0
Drinking and driving and foolish risks	0.67 ^b	0.3	0.64	0.4	14.29 ^h	9.8
Fighting and foolish risks	0.71 ^c	0.3	0.47	0.4	13.69 ⁱ	11.2
Accidents and injury	0.65	0.3	0.66	0.4	13.85 ^j	6.5
Minimal risks and consequences	0.74 ^d	0.3	0.58 ^f	0.4	10.58 ^k	9.1

^a PDA: Multiple risk class is lower ($p<0.05$) than drinking and driving, fighting, and minimal risk classes^b Drinking and driving class is higher ($p<0.05$) than multiple risks class^c Fighting class is higher ($p<0.05$) than multiple risks class^d Minimal risks class is higher ($p<0.05$) than multiple risks class^e PDHD: Multiple risks class is higher ($p<0.05$) than minimal risk class^f Minimal risk class is lower ($p<0.05$) than multiple risk class^g Maximum amount consumed: Multiple risk class is higher ($p<0.05$) than drinking and driving, fighting, accidents and injury, and minimal risk classes^h Drinking and driving class is lower ($p<0.05$) than multiple risks and higher than ($p<0.05$) minimal risks classesⁱ Fighting class is lower ($p<0.05$) than multiple risk class^j Accidents and injury class is lower ($p<0.05$) than the multiple risk class^k Minimal risks is lower ($p<0.05$) than multiple risks and drinking and driving classes.

Table 5

Covariates predicting class membership (low risk class comparison group)

Class	Effect	Estimate	S.E.	p	OR	95%CI
Multiple risks and consequences	Previous ED/hospital treatment for injury	1.27	0.28	0.00	3.54	2.1–6.1
	Causal attribution	1.31	0.29	0.00	3.69	2.1–6.5
	Gender	1.27	0.41	0.00	3.55	1.6–8.0
	Hispanic	–1.04	0.31	0.00	0.35	0.2–0.6
	Black	–1.55	0.41	0.00	0.21	0.1–0.5
Drunk driving foolish risk	Previous ED/hospital treatment for injury	0.41	0.23	0.08	1.51	1.0–2.4
	Causal attribution	0.62	0.25	0.01	1.87	1.2–3.0
	Gender	0.88	0.32	0.01	2.41	1.3–4.6
	Hispanic	–0.36	0.27	0.17	0.70	0.4–1.2
	Black	–0.60	0.32	0.06	0.55	0.3–1.0
Fighting and foolish risks	Previous ED/hospital treatment for injury	0.96	0.51	0.06	2.61	1.0–7.1
	Causal attribution	0.43	0.45	0.34	1.54	0.6–3.7
	Gender	0.69	0.64	0.28	1.99	0.6–6.9
	Hispanic	–0.52	0.56	0.35	0.59	0.2–1.8
	Black	–0.12	0.55	0.82	0.88	0.3–2.6
Accidents and injury	Previous ED/hospital treatment for injury	0.65	0.47	0.17	1.91	0.8–4.8
	Causal attribution	1.86	0.50	0.00	6.41	2.4–17.2
	Gender	0.20	0.55	0.72	1.22	0.4–3.6
	Hispanic	–0.35	0.52	0.50	0.71	0.3–2.0
	Black	–0.08	0.59	0.90	0.93	0.3–2.9

Table 6

Drinking levels and changes for baseline, 6, and 12 months^a

Class	Mean and SD			Changes in Mean			d of change	
	Base ^b	6 months	12 months	Base to 6 months	Base to 12 months	Base to 6 months	Base to 12 months	Base to 12 months
Percent days abstinent								
Multiple risks	52%	0.3	68%	0.4	69%	0.3	16%	0.47
Drunk driving	67%	0.3	77%	0.3	75%	0.3	10%	0.37
Fighting and foolish risks	75%	0.3	92%	0.1	91%	0.1	18%	0.86
Accidents and injury history	70%	0.3	83%	0.3	78%	0.3	12%	0.43
Minimal risks	76%	0.3	82%	0.3	77%	0.3	6%	0.23
Percent days heavy drinking								
Multiple risks	70%	0.4	61%	0.4	59%	0.4	-9%	0.24
Drunk driving	57%	0.4	52%	0.4	53%	0.4	-5%	0.11
Fighting and foolish risks	21%	0.1	51%	0.5	44%	0.4	31%	23%
Accidents and injury history	72%	0.4	55%	0.5	55%	0.5	-17%	0.39
Minimal risks	49%	0.4	38%	0.4	39%	0.4	-11%	0.26
Maximum amount consumed								
Multiple risks	19.4	12.0	10.6	8.7	11.4	11.0	-8.7	0.85
Drunk driving	14.3	10.3	8.3	9.3	7.9	8.3	-6.0	0.61
Fighting and foolish risks	11.6	8.4	4.6	4.2	5.4	3.8	-7.0	1.11
Accidents and injury history	12.9	6.5	5.6	5.7	6.9	5.7	-7.3	1.20
Minimal risks	9.2	5.8	5.3	6.1	6.2	6.5	-3.9	0.66

^a Bolded values represent $p < .05$

^b Baseline mean drinking values reported in Table 6 for the repeated measures ANOVA are different in some cases than those baseline values reported in Table 4 for the one-way ANOVA due to case deletion methods used for the repeated measures methods.