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A Brief Intervention Reduces Hazardous and Harmful Drinking in Emergency Department Patients

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Abstract

BACKGROUND—Brief interventions (BI) have been shown to reduce alcohol use and improve outcomes in Hazardous and Harmful (HH) drinkers but evidence to support their use in emergency department (ED) patients is limited. The use of research assessments in studies of BI may contribute to uncertainty about their effectiveness.

METHODS—We randomized 889 adult ED patients with HH drinking. A total of 740 received 1) an emergency practitioner (EP)-performed Brief Negotiation Interview (BNI, n=297), 2) BNI with a 1-month follow-up telephone booster (BNI with Booster), (n=295), or 3) standard care (SC, n=148). We also included a standard care with no assessments (SC-NA, n=149) group to examine the impact of assessments on drinking outcomes. Primary outcomes analyzed using mixed models procedures included past 7-day alcohol consumption and 28-day binge episodes at 6 and 12 months collected by Interactive Voice Response. Secondary outcomes included negative health behaviors and consequences collected by phone surveys.

RESULTS—The reduction in mean number of drinks in the past 7 days from baseline to 6 and 12 months was significantly greater in BNI with Booster: from 20.4 (95% confidence interval [CI], 18.8-22.0) to 11.6 (95% CI, 9.7-13.5) to 13.0 (95% CI, 10.5-15.5) and BNI: from 19.8 (95% CI, 18.3-21.4) to 12.7 (95% CI, 10.8-14.6), to 14.3 (95% CI, 11.9-16.8), than in SC: from 20.9 (95% CI, 18.7-23.2) to 14.2 (95% CI, 11.2-17.1), to 17.6 (95% CI, 14.1-21.2). The reduction in 28-day binge episodes was also greater in BNI with Booster: from 7.5 (95% CI, 6.8-8.2) to 4.4 (95% CI, 3.6-5.2) to 4.7 (95% CI, 3.9-5.6) and in BNI: from 7.2 (95% CI, 6.5-7.9) to 4.8 (95% CI, 4.0-5.6), to 5.1 (95% CI, 4.2-5.9), than in SC: from 7.2 (95% CI, 6.2-8.2) to 5.7 (95% CI, 4.5-6.9), to 5.8 (95% CI, 4.6-7.0). BNI with Booster offered no significant benefit over BNI. There were no differences in drinking outcomes between the SC and SC-NA groups. The reductions in rates of driving after drinking 3 drinks from baseline to 12 months were greater in the BNI (38% to 29%) and BNI with Booster (39% to 31%) groups than in the SC group (43% to 42%).

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CONCLUSIONS—EP-performed brief interventions can reduce alcohol consumption and episodes of driving after drinking in HH drinkers. These results support the use of brief interventions in ED settings.

Keywords

Alcohol drinking; psychotherapy brief; emergency service; hospital; emergency medical services

INTRODUCTION

Background

Alcohol problems are prevalent in Emergency Department (ED) populations.^{1,2} Individuals may seek medical care, for acute illness and injury related to alcohol, or are identified through universal screening.^{3,4,5,6,7,8,9} These individuals often receive their care in EDs in lieu of primary care settings,¹⁰ resulting in significant health care costs.^{Error! Bookmark not defined., 11} Hazardous and harmful drinking (HH),¹² consuming >14 drinks/week and/or >4 drinks/occasion for men, and >7 drinks/week and/or >3 drinks/occasion for women and all individuals over 65 years, with or without negative consequences, is a major focus of screening, brief intervention, and referral to treatment (SBIRT) efforts in health care settings.^{13,14,15}

Importance

Evidence exists for the use of brief interventions (BI) for alcohol in primary care,^{16,17,18} and inpatient trauma settings.¹⁹ The data in ED settings are less clear. While consumption decreases over time^{20,21,22,23,24} few studies have identified benefits specific to BI in ED patients. A recent meta-analysis of strategies targeting alcohol problems in the ED found that BI did not significantly reduce drinking but was associated with a 50% reduction in alcohol-related injury.²⁵ Methodological heterogeneity across studies makes it difficult to draw conclusions concerning the efficacy of BI in ED patients.²⁶ Differences in screening tools, application to universal or injured only populations, the targeting of the intervention from at-risk to dependence drinkers and variation in measures or definitions make it difficult to compare studies.²⁷ There is an additional concern that research assessments of alcohol consumption can themselves lead to decreased drinking²⁸ thus making it difficult to separate the assessment effect from the overall intervention outcomes.

Goals of the Investigation

We conducted a study designed to evaluate the efficacy of a brief intervention, the Brief Negotiation Interview (BNI), and to address the concern of a research assessment effect. We hypothesized that in HH drinkers both 1) past 7-day alcohol consumption and 2) binge episodes during the past 28 days would be reduced most in an enhanced BNI with a 1-month booster (BNI with Booster) condition as compared to BNI alone or a standard care (SC) control condition, and that the BNI would be superior to SC. Additionally, we hypothesized that BNI with Booster and BNI would be superior to SC in reducing negative health behaviors and consequences. Finally, we hypothesized that assessments reduce drinking and thus added a non-assessed standard care group (SC-NA) to evaluate the impact of assessments.

METHODS

Study Design and Overview

We conducted a randomized clinical trial comparing the efficacy of (1) BNI performed by emergency practitioners (EPs), and (2) the BNI with Booster with a nurse-performed booster telephone call at 1-month, to SC. To reduce or eliminate the potential social desirability bias in reporting alcohol consumption, the primary outcomes in the BNI, BNI with Booster and SC groups were evaluated at baseline, 6 months, and 12 months by Interactive Voice Response.²⁹ To assess the effect of assessments on alcohol consumption, we also included the SC-NA (no assessment group) for comparison with the assessed SC group.

Setting and Participants

We randomized 889 HH drinkers. A total of 740 were randomized to the BNI (n= 297), BNI with Booster (n=295), and SC (n=148) and an additional (n=149) were included in the SC-NA group. Participants were 18 years old presenting to an urban teaching hospital with approximately 75,000 ED visits/year. Patients were excluded if their Alcohol Use Disorders Identification Test (AUDIT)³⁰ score was >19 (consistent with alcohol dependence)³¹, were enrolled in alcohol treatment, presented with life-threatening conditions, were actively suicidal or psychotic, or were non-English speaking. Ten were excluded post-randomization: nine were ineligible and one due to Interactive Voice Response malfunction. One study identification number of the originally planned 150 in the SC-NA group was inadvertently not used. Figure 1 depicts the flow diagram of study subjects. A total of 740 subjects randomized to BNI, BNI with Booster and SC groups were included in the analyses of study outcomes across three time points, and the 12-month outcomes from the SC-NA and SC groups were compared.

ED patients were universally screened and recruited during rotating 8-hour shifts covering 7 days per week from 5am to 11pm. Patients with overt exclusions such as those less than 18 years of age, in police custody, or sent from an extended care facility were not approached. Quantity and frequency questions recommended by The National Institute on Alcohol Abuse and Alcoholism³² to identify HH drinkers were embedded in a 17-item general health questionnaire administered by research associates (RAs). Patients who screened positively as HH drinkers and met inclusion criteria, were consented to participate in the study and randomized using a 100-block randomization procedure (RAs were provided with sealed envelopes for each of the study identification numbers). Participants received \$20 at the index visit, 6 and 12 month assessments. This study was approved by the Yale University Human Investigation Committee and registered with [ClinicalTrials.gov](https://clinicaltrials.gov/ct2/show/study/NCT00261859) (NCT00261859).

Study Interventions

The manual-guided BNI includes (1) raising the subject of alcohol; (2) providing feedback by reviewing the patient's screening data and connecting alcohol and the visit/illness or injury and reviewing guidelines for low-risk drinking; (3) enhancing motivation by asking how likely the patient is to change his/her drinking on a scale from 1 to 10 and exploring why s/he did not choose a lower number; and (4) negotiating a drinking goal. Patients were also asked to sign a drinking agreement. EPs who performed the BNI, including attending physicians and residents, physician associates, and advanced practice registered nurses, received a 2-hour training program and proficiency testing.³³ All BNIs were audio-taped, the median duration was 7 minutes with an inter-quartile range (IQR) of 3 (25th percentile=6 minutes; 75th percentile=9 minutes).

The BNI with Booster group received an additional telephone booster intervention at 1-month by a trained primary care nurse. If the patient reduced drinking to low-risk levels,

their methods were reinforced and relapse prevention was discussed. If they were still above low-risk limits, an attempt was made to negotiate a new agreement or to consider a change in the future. Coping skills and stressors were assessed and motivational strategies for change were offered. The median number of attempts the nurses needed to make to complete the Booster call was 1, with an IQR of 2 (25th percentile=1; 75th percentile=3). All boosters were audio-taped, the median duration was 10 minutes with an IQR of 3 (25th percentile =7 minutes, 7 seconds; 75th percentile = 12 minutes, 11 seconds. Patients randomized to SC received no further screening beyond the general health questionnaire or intervention targeting alcohol use.

Primary and Secondary Outcomes

The primary study outcomes, past 7-day alcohol consumption, measured by the time-line follow back method³⁴, and the number of binge drinking episodes in the past 28 days, >4 drinks per occasion for men and >3 drinks per occasion for women and all >65 were collected by the Interactive Voice Response system using a touch tone phone. Secondary outcomes included: driving after drinking episodes, the Short Inventory of Problems (SIP),³⁵ the Revised Injury Behavior Checklist (IBC),³⁶ arrests or motor vehicle crashes while intoxicated, legal and employment problems; and Treatment Services Review (TSR).³⁷ The SIP was also collected by Interactive Voice Response, and the TSR, IBC, and other data specifically related to drinking and driving were collected by face-to-face RA interviews.

Measurements

Baseline Assessments—The Health Questionnaire was collected by the RA as the initial screen and determined eligibility. In the BNI, BNI with Booster and SC groups, alcohol consumption using time-line follow back methods and the SIP data were collected by the Interactive Voice Response system using a touch tone phone at the time of the index visit. The median (IQR) times for the Interactive Voice Response and face to face interviews were 10 (5) minutes and 9.7 (6) minutes respectively. The SC-NA group was screened for enrollment at baseline by the Health Questionnaire only, with locator and demographic information also collected. They did not receive any research assessments until they were evaluated at 12 months by Interactive Voice Response and RA phone interview.

Follow-up Assessments—Alcohol consumption at 6 and 12 months and the SIP at 12-months were collected by the Interactive Voice Response system available to study participants during 4 weeks before and 6 weeks after the scheduled 6 and 12 month follow up dates. All other negative consequences included as secondary outcome data were collected by RAs via phone interview at 6 and 12 months. In cases where the IVR was not completed on schedule, the RA called the patient and directly linked them into the system. In all cases, the IVR data was collected prior to the other information collected by phone interview. The RAs were blinded to study group assignment.

BNI and BNI with Booster Adherence—To assess BNI and booster fidelity, we used an 11-item scale^{Error! Bookmark not defined.}, supplemented with a 13-item checklist for the BNI with Booster session. Audiotapes of BNI and booster encounters were rated by three independent, trained raters who were blinded to study hypotheses and treatment assignment. A total of 572/592 (97%) tapes were rated. Of the twenty that were not reviewed, 2 patients refused and the remaining were due to technical difficulties, inaudible recordings or tape recording malfunctions. The mean adherence score for the BNI was 8.5 out of 11 possible items (77.5%). The mean score for the booster was 9.4 out of 13 items (73%) indicating good adherence.

Primary Data Analyses

Power calculations were based on published data³⁸ indicating an expected effect of 0.33 in reduction of alcohol use between the experimental and control conditions. A total sample of 900 patients provided power (>0.80) to detect the hypothesized low-to moderate-sized effects (assuming a type I error of 0.05).

We evaluated distributional properties of the data before conducting statistical analyses. Because alcohol consumption and binge responses were highly skewed, the Interactive Voice Response data were log-transformed prior to statistical analyses. The primary analyses were based on the intention-to-treat principle and included all patients in the BNI, BNI with Booster and SC groups (n=740). The mixed models procedures (SPSS 17) were used to analyze continuous, repeated measures data to evaluate the statistical significance of treatment effects, time effects (baseline, 6 months, and 12 months), and their interactions. The mixed models procedures uses all available data on each subject; therefore, all study participants, including those with missing data are included in the analyses.^{39,40} "Trajectories/lines" rather than individual data points estimate the missing data points. These trajectories are based on the actual data from individual study subjects, but also on the overall behavior of the entire sample, as well as on the behavior of the comparison groups to which the study subjects are randomized. Therefore, the complete study sample is always analyzed without excluding participants with missing data. There is little bias due to missing data when there is no evidence of differential dropout rates among groups.

Because of the potential concern of the effect of missing data on the study outcomes, we also conducted a series of sensitivity analyses on both primary outcome measures. In these supplemental analyses, we used a range of possible hypothetical models or assumptions about the missing data. The models evaluated in our sensitivity analyses included the following: (1) "the last observation carry-forward" (LOCF)^{41,42} where missing data at follow up are replaced by the last available data point (based on an assumption that patients who did not complete the follow up assessments did not change their pattern of drinking from the last measured point); (2) where missing data were replaced with zeros (based on an assumption that patients who did not complete the follow up assessments stopped drinking altogether); and (3) where missing data were replaced with the baseline drinking levels (based on an assumption that patients who did not complete the follow up assessments returned to their pre-treatment drinking levels).

Additionally, based on the National Survey on Drug Use and Health,⁴³ all study participants were classified into two age groups: young adults (18-25) and older adults (> 26). In separate analyses, we evaluated the effect of age group, sex, and presence of an injury on the hypothesized treatment effects, using the specified primary outcome measures and the statistical methods described above (i.e., the repeated measures mixed models procedures with age, sex and injury as covariates).

Separate analyses of differences between the SC and SC-NA groups were conducted to estimate the contribution of assessments to the overall effects of the BNI interventions. We used separate t-tests to evaluate the differences on the two primary drinking outcomes at 12-month assessment between the SC and SC-NA groups.

We used nonparametric tests (Wilcoxon signed rank test) to evaluate changes between baseline and 12 months on count variables and mixed models on continuous repeated variables to evaluate the hypothesized effects on the secondary outcome measures.

Because data on 7-day alcohol consumption (number of drinks per week) at the index visit for participants enrolled in the BNI, BNI with Booster and SC groups were collected using

the face-to-face Health Questionnaire interview (to screen eligible study participants) and also as part of the baseline assessment using Interactive Voice Response, we conducted an exploratory analysis (paired t-test) of the agreement between these data, to evaluate potential differences in alcohol consumption reporting based on the data collection method.

RESULTS

Characteristics of Study Subjects

The baseline characteristics of randomized subjects (N=889) are shown in Table 1. The groups were similar on all of the baseline characteristics.

Treatment delivery, data collection and participant retention

All participants randomized to the BNI, BNI with Booster and SC, groups received treatment as assigned and 81% of BNI with Booster subjects received the booster. The proportions of patients completing Interactive Voice Response assessment at 6 months were 179/297 (60.3%), 174/295 (59.0%), 73/148 (49.3%); and at 12 months were 181/297 (60.9%), 169/295 (57.3%), 86/148 (58.1%), for the BNI, BNI with Booster and SC groups respectively. The proportions of patients completing 6 month telephone interview were 252/297 (84.8%), 254/295 (86.1%), 122/148 (82.4%); and at 12 month were 254/297 (85.5%), 261/295 (88.5%), 122/148 (82.4%), for the BNI, BNI with Booster and SC groups respectively. In the SC-NA group, 74/149 (49.7%) completed the 12 month Interactive Voice Response assessment, and 122/149 (81.8%) completed the RA interview.

Alcohol Consumption

All three groups decreased their alcohol consumption over time. The reductions in the mean number of drinks per week ($p=0.045$) and binge episodes ($p=0.031$) were significantly greater for the BNI and BNI with Booster groups compared to the SC group (Table 2). There were no statistically significant differences in drinking outcomes between the BNI with Booster and BNI groups. We also found significant main effects of age ($p=0.016$ for the number of drinks per week, and $p<0.001$ for the number of bingeing episodes per month), and significant interactions between age and treatment group on both primary outcome measures ($p=0.002$ for the number of drinks per week, and $p=0.007$ for the number of bingeing episodes). (Figure 2) There were no differences in treatment outcomes related to sex or presence of an injury.

Additionally, the sensitivity analyses support the same pattern of reductions of alcohol consumption on both primary outcome measures in all study groups: both the BNI with Booster and the BNI groups show virtually overlapping reductions over time in the number of drinks and bingeing episodes that are greater from the reductions observed in the SC group. Figure 3 shows the pattern of outcomes produced by the mixed models procedures as presented in Table 2. Figure 4 illustrates the hypothetical situation where all missing data are replaced with the last available data (LOCF).“ Figure 5 is based on the data where all missing values are replaced with zeros, and Figure 6 is based on the date were all those with missing data returned to their individual baseline drinking levels.

The mean (SD) number of drinks per week reported by the SC-NA group at 12 months was 16.6 (14.2), compared to 17.6 (17.7) in the SC group ($p=0.67$), and the number of binge days/month 6.9 (6.8) compared to 5.8 (5.6) in the SC group ($p=0.60$), were not significantly different. (Figure 7)

In an exploratory analysis of the data from the Health Questionnaire and Interactive Voice Response we found that participants reported on average 1.4 (95%CI: 0.8-2.0) drinks more

per week using the Interactive Voice Response than on the face-to-face Health Questionnaire ($p<0.001$).

Negative Behaviors and Consequences

We found a statistically significant effect of treatment intervention on impaired driving practices with patients who received the BNI and BNI with Booster reporting greater reductions in the rates of driving after having three or more drinks from baseline to 12 months (38% to 29%, and 39% to 31%, respectively), as compared to patients who received SC (43% to 42%, $p=0.04$). There were no statistically significant differences among the groups on changes in TSR, SIP or IBC scores, numbers of arrests for driving under the influence, or contacts with the legal system from baseline to follow up. (Table 2) The reported numbers of motor vehicle crashes while intoxicated and missed days of work decreased over time without a treatment effect (Table 3).

LIMITATIONS

This study was conducted at one site: a teaching hospital associated with an academic institution. Of note however, we were able to train a large number of EPs with a variety of training and experience. In order to demonstrate efficacy of the intervention, high levels of treatment and study protocol adherence are essential and can best be accomplished at one site. While our data are based on self report, we employed a reliable time-line follow back method³⁴ to collect alcohol consumption data. We also employed Interactive Voice Response technology which offers an opportunity to collect data without patient-staff interaction and can reduce social desirability bias. We found that there was a 1.4 drink/week difference using this method of collection as compared to a face-to-face assessment. While Interactive Voice Response may be a more accurate tool for follow-up assessment, the system's voice is mechanical and slow, considerably limiting feasibility to collect longer time line follow-back and other long assessment and our study subjects were less likely to use the Interactive Voice Response system than to speak directly to an RA on the telephone. Consequently the past 7-day alcohol use was amenable to use of TLFB methods using Interactive Voice Response, but too onerous to be used for 28 day binge episodes. All 740 patients were included in the analyses; however, there were missing data at both 6 and 12 months. The mixed models procedures are designed to deal with this, with little bias due to missing data. Future implementation of Interactive Voice Response may require more extensive practice at the index ED visit including a deceptive trial for those randomized to the no assessment group.

DISCUSSION

EP-performed brief interventions for HH drinkers significantly reduced alcohol consumption and decreased impaired driving. Contrary to our hypothesis, the booster offered no additional benefit. This demonstrates that a brief intervention performed solely with existing staff, during a visit to a large, urban ED setting, can be effective. The greater reductions from baseline to 12 months in mean number of drinks per week in the BNI with Booster and BNI groups (7.4, 5.5) compared to the SC group (3.3), and in the number of monthly bingeing episodes in the BNI with Booster, BNI groups (2.8, 2.1) compared to SC group (1.4) are relevant due to the possibility of decreased alcohol levels particularly while driving, and injury events. The intervention was most pronounced among those 26 years old, while drinking and bingeing episodes in younger patients showed a stronger rebounding trend toward their baseline values at 12 months, suggesting that additional modifications to the intervention either in content and/or intensity may be needed for this group. This large study provides support of improved health outcomes efficacy of brief interventions for HH drinkers in the ED settings. Given that injury, specifically motor vehicle crashes, is the

leading cause of mortality and morbidity for adults³⁴, and alcohol-impaired driving crashes account for nearly 11,000 crash fatalities, or about one third of all crash fatalities in the United States, this reduction in drinking and driving is of major importance.^{44,45} In 2010, approximately 4 million adults reported at least one episode of alcohol-impaired driving. Men accounted for 81% of alcohol-impaired episodes with those aged 21-34 years accounting for 32% of all episodes.^{Error! Bookmark not defined.} Thus, further investigation of interventions particularly focusing on younger men is warranted.

Previous systematic reviews of alcohol studies in adult ED populations highlighted substantial methodological heterogeneity and results have shown limited efficacy.⁴⁶ Disparate results largely stem from methodologic limitations in the interventions and outcomes. The current study, which demonstrated an effect of treatment, attempted to address these concerns by using universal screening, a credible control condition, Interactive Voice Response methodology to limit patient-staff interaction, and relatively short assessments in an attempt to limit the effect of assessments on drinking. We also examined the impact of assessment reactivity by adding the SC-NA group. However, contrary to our original hypothesis, our assessment had no significant effect on drinking reductions, thus supporting the effectiveness of the BNI itself.

Though the evidence for brief interventions for alcohol in the ED setting has been modest until now, advocacy groups have succeeded in introducing accreditation standards. The American College of Surgeons requires Level I trauma centers to provide alcohol screening and brief intervention for all injured patients.⁴⁷ For the past three years, the Substance Abuse and Mental Health Services Administration has provided funding to train resident physicians in screening, brief intervention, and referral to treatment (SBIRT) in all primary care specialties at 17 institutions.⁴⁸ The current study adds to the evidence in support of brief interventions in general ED patients.

We hope that identifying effective interventions for ED populations will shift the current clinical practice paradigm to include SBIRT for all individuals with HH drinking. The current study is the only study to use EPs to perform brief interventions rather than funded research staff. Our findings demonstrate the feasibility and efficacy of using existing staff to perform such interventions, approximately 7 minutes in length, during routine ED visits which may enhance sustainability. A single booster, requiring additional resources, did not improve outcomes.

In conclusion, brief interventions performed by EPs reduce alcohol consumption and episodes of impaired driving. These findings have implications for practice and health policy.

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FIGURE 1. Consort Diagram

FIGURE 2. Alcohol Consumption by Age

FIGURE 3. Alcohol Consumption (mixed models)

FIGURE 4. Alcohol Consumption (missing replaced by the Last Observation Carried-Forward)

FIGURE 5. Alcohol Consumption (missing replaced by zeros)

FIGURE 6. Alcohol Consumption (missing replaced with baseline values)

FIGURE 7. Comparison of Standard Care with Standard Care No Assessment Group

TABLE 1
Characteristics of Study Subjects

	BNI with Booster (n=295) # (%)	BNI (n=297) # (%)	Control	
			SC (n=148) # (%)	SC-NA (n=149) # (%)
Sex				
Male	215 (73)	208 (70)	111 (75)	105 (71)
Age, y, mean (SD)				
Male	32.3 (14.2)	30.7 (13.2)	35.0 (15.4)	33.2 (15.1)
Female	35.5 (16.0)	30.7 (13.4)	31.4 (13.7)	30.9 (13.9)
Marital Status				
Single	212 (72)	225 (76)	98 (66)	118 (79)
Widowed, divorced, separated	29 (10)	21 (7)	23 (16)	13 (9)
Married	54 (18)	50 (17)	27 (18)	18 (12)
Other	0	1 (0)	0 (0)	0 (0)
Education				
High school or less	119 (40)	120 (40)	72 (49)	48 (32)
Some college	129 (44)	131 (44)	56 (38)	55 (37)
College degree or more	47 (16)	46 (16)	20 (13)	12 (8) *
Race				
White	189 (64)	189 (64)	86 (58)	95 (64)
Black	58 (20)	57 (19)	38 (26)	39 (26)
Hispanic	40 (14)	43 (14)	22 (15)	13 (9)
Other	7 (2)	8 (3)	2 (1)	1 (1)
Insurance Coverage				
Private (HMO/Private)	183 (78)	188 (80)	88 (73)	72 (76)
Medicare/Medicaid	47 (20)	42 (18)	28 (19)	25 (17)
Other	4 (2)	4 (2)	5 (4)	0 (0)
Primary Physician	206 (70)	186 (63)	91 (62)	89 (60)
Usual Source of Care				
Clinic	48 (16)	64 (21)	27 (18)	31 (21)
ED or none	70 (24)	70 (24)	39 (26)	45 (31)
Private doctor	177 (60)	162 (55)	81 (55)	73 (49)
Other	0 (0)	1 (0)	1 (1)	0 (0)
Injured at ED presentation	99 (34)	107 (36)	63 (43)	47 (32)
AUDIT mean SD	11 (4)	11 (4)	12 (4)	11 (4)

	BNI with Booster (n=295) # (%)	BNI (n=297) # (%)	Control	
			SC (n=148) # (%)	SC-NA (n=149) # (%)
Smoking status				
Smokers	134 (45)	155 (50)	83 (51)	83 (56)

* category does not equal 100% due to missing data in the SC without assessment group

TABLE 2

Outcomes

ALCOHOL CONSUMPTION					
	Baseline, Mean (95% CI)	6 months, Mean (95% CI)	12 months, Mean (95% CI)	Time Effect	Treatment Effect
Mean number of drinks in the past 7 days				$P<.001$	$P=.045$
(BNI with Booster)	20.4 (18.8-22.0)	11.6 (9.7-13.5)	13.0 (10.5-15.5)		
(BNI)	19.8 (18.3-21.4)	12.7 (10.8-14.6)	14.3 (11.9-16.8)		
(SC)	20.9 (18.7-23.2)	14.2 (11.2-17.1)	17.6 (14.1-21.1)		
Mean number of binge drinking days in the past 28 days				$P<.001$	$P=.031$
(BNI with Booster)	7.5 (6.8-8.2)	4.4 (3.6-5.2)	4.7 (3.9-5.6)		
(BNI)	7.2 (6.5-7.9)	4.8 (4.0-5.6)	5.1 (4.2-5.9)		
(SC)	7.2 (6.2-8.2)	5.7 (4.5-6.9)	5.8 (4.6-7.0)		

NEGATIVE CONSEQUENCES				
	Baseline n (% , 95% CI)	12 months, n(% , 95% CI)	Time Effect	Treatment Effect
Reported driving after drinking 3 drinks one time in the past 12 months			$P=.025$	$P=.040$
(BNI with Booster)	116/295 (39% , 34%-45%)	81/260 (31% , 26%-37%)		
(BNI)	113/297 (38% , 33%-44%)	74/253 (29% , 24%-35%)		
(SC)	64/148 (43% , 36%-51%)	51/122 (42% , 33%-51%)		
	Mean (95%CI)	Mean (95% CI)		
Short Inventory of Problems score, mean(SD)			$P=.653$	$p=.310$
(BNI with Booster)	6.69 (5.90-7.48)	7.33 (6.09-8.58)		
(BNI)	6.99 (6.17-7.82)	6.11 (5.06-7.16)		
(SC)	7.04 (6.00-8.09)	6.64 (5.00-8.28)		
Injury Behavior Checklist score (mean)			$P<.001$	$P=.852$
(BNI with Booster)	0.67 (0.41-0.92)	0.26 (0.17-0.35)		
(BNI)	0.59 (0.43-0.76)	0.22 (0.10-0.34)		
(SC)	0.61 (0.42-0.80)	0.19 (0.08-0.30)		

Note: All 740 patients are included in the analyses using mixed models procedures. The numbers of patients who responded at 6 and 12 month follow up point are described in the Results Section.

TABLE 3
Other Negative Consequences

	BASELINE n (%)	12 MONTHS n (%)	Time Effect	Treatment Effect
Arrested for driving under the influence in the past 12 months				
(BNI with Booster) (BNI) (SC)	5/295 (2%) 5/297 (2%) 4/148 (3%)	6/261 (2%) 6/254 (2%) 3/122 (3%)	$P=.501$	$P=.758$
Motor vehicle crash while intoxicated in the past 12 months				
(BNI with Booster) (BNI) (SC)	24/295 (8%) 24/297 (8%) 16/148 (11%)	13/260 (5%) 10/253 (4%) 5/122 (4%)	$P<.01$	$P=.83$
Contact with legal system in the past 12 months				
(BNI with Booster) (BNI) (SC)	32/294 (11%) 41/297 (14%) 13/148 (9%)	21/259 (8%) 16/253 (6%) 11/122 (9%)	$P=.078$	$P=.387$
Missed at least 1 work day (past 30 days)* * n = # pts reporting employment				
(BNI with Booster) (BNI) (SC)	63/191 (33%) 52/186 (28%) 31/105 (30%)	26/158 (17%) 19/149 (13%) 6/81 (7%)	$P<.001$	$P=.163$