Published in final edited form as:

J Stud Alcohol Drugs. 2008 July ; 69(4): 550–560.

Brief Alcohol Intervention in the Emergency Department: Moderators of Effectiveness

M.A. Walton³, A. L. Goldstein⁴, S.T. Chermack^{1,3}, R.J. McCammon³, R.M. Cunningham²,
K.L. Barry^{1,3}, and F.C. Blow^{1,3}

¹Department of Veterans Affairs, Health Services Research and Development, Ann Arbor, MI

²Department of Emergency Medicine, University of Michigan, Ann Arbor, MI

³Department of Psychiatry, University of Michigan, Ann Arbor, MI

⁴Department of Psychology, York University, Toronto, ON

Abstract

Objective—Prior research supports the effectiveness of brief interventions for reducing alcohol misuse among patients in the Emergency Department (ED). However, limited information is available regarding the mechanisms of change, which could assist clinicians in streamlining or amplifying these interventions. This paper examines moderators of outcomes among ED patients, ages 19 and older, who participated in a randomized controlled trial of a brief intervention for alcohol misuse.

Method—Injured patients ($N=4,476$) completed a computerized survey; 575 at-risk drinkers were randomly assigned to one of four brief intervention conditions and 85% were interviewed again at 3- and 12-month follow-ups.

Results—Regression models using the GEE approach examined interaction effects between intervention condition (advice / no advice) and hypothesized moderator variables (stage of change, self-efficacy, acute alcohol use, attribute injury to alcohol) on alcohol outcomes over time. Overall, participants who reported higher levels of self-efficacy had lower weekly consumption and consequences whereas those with higher readiness to change had greater weekly consumption and consequences. Further, individuals who attributed their injury to alcohol and received advice had significantly lower levels of average weekly alcohol consumption and less frequent heavy drinking from baseline to 12-month follow-up compared to those who attributed their injury to alcohol but did not receive advice.

Conclusions—This study provides novel data regarding attribution for alcohol related injury as an important moderator of change and suggests that highlighting the alcohol-injury connection in brief ED-based alcohol interventions may augment their effectiveness.

Introduction

In the United States, there are over 100 million emergency department (ED) visits each year (NCHS, 2000) with injuries making up 37% of ED visits (McCaig and Burt, 2003). Numerous studies have found a relationship between alcohol use and injury (Cherpitel, 1988a; Cherpitel, 1988b; Cherpitel, 1989; Cherpitel, 1993c; Cherpitel, 1999; Hingson et al., 1985; Hingson and Howland, 1987; Kerr et al., 1987). Alcohol is involved in up to 50% of inpatient cases admitted due to trauma (Rivara et al., 1993; Soderstrom et al., 1988) and in

nearly 50% of all motor-vehicle crash deaths, suicides and homicides (Perrine et al., 1989). Although estimates vary, on average one-quarter of injured adults presenting to the ED have positive blood alcohol concentrations (range 4% – 46%; Cherpital et al., 2005) and nearly one in five injured adult ED patients has a diagnosis of alcohol use disorder (Maio et al., 1997; Soderstrom et al., 1997a).

The health care context of the ED visit provides an opportunity to screen for alcohol use disorders and identify individuals at risk for problem drinking, even if the visit is not explicitly alcohol-related (Fleming et al., 2007). The ED visit may also represent a unique “teachable moment” where patients may be more receptive to interventions for alcohol misuse (Cherpitel, 1993b; Cherpitel, 1997; Conigrave et al., 1991; Dowey, 1993; Maio, 1995; Monti et al., 2001b). Because most injured ED patients (97%) are treated and released (McCaig and Burt, 2001) it is desirable to intervene during the ED visit, where lengthy wait times lend themselves to the delivery of brief interventions (BIs) adapted from motivational interviewing (MI; Miller and Rollnick, 2002; Burke et al., 2003). Overall, reviews have concluded that BIs targeting alcohol use delivered in primary care settings reduce drinking by 20–30%, that these effects are maintained over time, and that BIs are efficacious as both single session stand-alone treatments, and as a prelude to other treatments. Further, in primary care settings, BI effects are generally stronger for women than men (Babor and Grant, 1992; Barry, 1999; Bien et al., 1993; Burke et al., 2003; Dunn et al., 2001; Fleming et al., 1997; Fleming et al., 1999; Poikolainen, 1999).

Interventions delivered in the ED have the potential to reduce costs associated with injury and other alcohol-related health consequences (Fleming et al., 2002; Gentilello, 2005; Kunz et al., 2004). As a result, guidelines established by the American Academy of Emergency Medicine recommend alcohol screening and brief interventions in ED settings (<http://www.aaem.org/>). Previous researchers have examined the effectiveness of BIs in the ED, using both adolescent (Gregor et al., 2003; Monti et al., 1999; Monti et al., 2001a), and adult (Bazargan-Hejazi et al., 2005; Blow et al., 2006; Johnston et al., 2002; Leontieva et al., 2005; Longabaugh et al., 2001; Mello et al., 2005; Neumann et al., 2006; Gentilello et al., 1999; Welte et al., 1998) samples. To date, the findings have been mixed, primarily demonstrating modest reductions in either alcohol consequences (Bazargan-Hejazi et al., 2005; Blow et al., 2006; Longabaugh et al., 2001; Mello et al., 2005; Monti et al., 1999) or consumption (Blow et al., 2006; Gentilello et al., 1999; Neumann et al., 2006). A prior paper from this study examined the effectiveness of a tailored BI on reducing alcohol misuse among injured ED patients (Blow et al., 2006). Overall, drinking was reduced by 48.5% in the advice with tailored booklet condition and young women in the advice conditions significantly decreased their frequency of heavy drinking as compared to those in the no advice conditions.

Additional information concerning moderators of treatment efficacy might assist in streamlining or amplifying the effectiveness of BIs in ED settings. In particular, identifying pre-intervention characteristics that may enhance or attenuate intervention outcomes among subgroups would enable further focusing of BIs to participant characteristics. Two participant characteristics that may have a significant impact for MI-based interventions are readiness to change drinking and self-efficacy. In addition, in the ED setting, participants may be more receptive to a BI if the reason for their ED visit (i.e., injury) occurs recently after drinking alcohol or they perceive the injury as alcohol-related.

Although readiness to change has been conceptualized as an important factor in predicting response to a BI, surprisingly little research has been conducted in this area. According to Prochaska and DiClemente’s (Prochaska and DiClemente, 1983) transtheoretical model of change, individuals with greater readiness to change should be more receptive to

interventions and should show greater treatment engagement and outcome. A recent ED study found that readiness to change predicted decreases in alcohol problem scores at three-months post-intervention, but moderators could not be examined because all participants received a BI (Leontieva et al., 2005). Another BI study of at-risk drinkers in the ED found that stage of change was not a moderator of treatment outcome; however, contemplation stage of change predicted worse outcomes at a 6-month follow-up compared to precontemplation and action (Neumann et al., 2006). Two non-ED based studies did not find a moderating effect for readiness to change on intervention response (Heather et al., 1996; Maisto et al., 2001). Instead, one study found that among the subset of participants were not ready to change, those who received the BI showed greater reductions in drinking (Heather et al., 1996). The other study found that contrary to hypotheses, individuals who received the BI and had greater readiness to change at baseline reported the highest levels of alcohol use at 12 months (Maisto et al., 2001). Thus, to date, research findings supporting stage of change as a moderator of treatment outcome are inconsistent.

Although enhancing self-efficacy is a standard component of brief interventions (Barry, 1999; Miller and Rollnick, 2002), there is also a paucity of research on self-efficacy as a moderator of BIs. Among substance use treatment samples, perceived confidence in making changes is an important predictor of reductions in drinking over time (Blume et al., 2003). Data from Project MATCH indicated that higher baseline self-efficacy was associated with better drinking outcomes one-year post treatment (Ilgen et al., 2006). Similarly, in a study of behavioral couples treatment for alcohol use disorders, lower self-efficacy at the end of treatment was associated with poorer drinking outcomes during a 1-year follow-up (McKay et al., 1993). When examined as a moderator of outcome in ED-based studies, however, findings have generally not demonstrated a moderating effect for self-efficacy on the effectiveness of BIs (Bazargan-Hejazi et al., 2005; Monti et al., 2001a).

Another potentially important moderator for ED-based BIs is the extent to which alcohol prompted the ED visit. Theoretically, whether alcohol was consumed prior to the injury and whether the injury is attributed to alcohol consumption should impact treatment response due to increased salience of alcohol's role in the injury, greater motivation to change, and the opportunity for intervening immediately following the alcohol-event, thereby highlighting the use of a "teachable moment" (Barnett et al., 2006; Cherpitel et al., 2006b). Previous studies have found no link between drinking prior to injury and intervention effectiveness (Longabaugh et al., 2001). To our knowledge, previous studies have not examined patients' attributions concerning whether their injury was related to their alcohol use.

This paper fills an important gap in the literature by identifying moderators of treatment outcome among injured ED patients who participated in a randomized controlled trial of a BI (Blow et al., 2006). By examining moderators of treatment effectiveness, BIs may be adapted to address the needs of sub-groups that are less responsive. It was conceptualized that characteristics of the participants drinking in relation to their injury would increase the saliency of the "teachable moment" during the ED visit, and thus would increase the potency of the advice session. The moderators selected for inclusion were based on theory and prior findings. Specifically, the primary hypotheses were that the effectiveness of the advice session on drinking outcome would be augmented among participants with greater self-efficacy and readiness to change, recent/acute alcohol consumption, and who attributed their injury to alcohol use.

Methods

Design

Injured patients (age 19 and older) presenting to a Midwest Level 1 Emergency Department (ED; between 8am and midnight) completed a computer-based survey of health issues (see Blow et al., 2006 for additional information) and were entered in a monthly draw for \$100. Eligible participants were randomly assigned to one of four intervention conditions: advice + tailored booklet, advice + generic booklet, no advice + tailored booklet, or no advice + generic booklet. Because extensive research demonstrates brief alcohol interventions are effective, a traditional “no-treatment/control” condition was not included but rather was approximated by the no advice + generic booklet condition. Following a saliva alcohol test to verify competency (e.g., BAC 100 mg/dl or less) participants received the appropriate intervention prior to discharge and completed follow-up interviews at 3- and 12-months. The study protocol was approved by the University Institutional Review Board for the use of human subjects.

Participants

Participants eligible for the study included ED patients 19 years of age or older who had been injured in the last 24 hours. Trained research staff determined injury classification (based on definitions of E-codes 800–968; International Classification of Diseases, 1995). Patients were excluded if they: were severely injured (e.g. unconscious, intubated, or in need of immediate lifesaving medical procedures); presented with a self-inflicted injury, sexual assault, overdose, poisoning, near drowning, chronic injury without specific event associated with re-injury; or were pregnant, prisoners, or did not speak English. During the recruitment period, 6,047 potentially eligible patients presented to the ED; 507 (8.4%) of patients were missed, mostly due to research staff being occupied with other patients or unable to locate the patient, or due to medical staff presence with the patient. Of the 5,540 patients approached to participate, 4,476 (80.8%) consented and 1,064 (19.2%) refused. (Assuming all the missed patients were eligible for screening, a more conservative estimate of the response rate is 74%; 4476 participants / 6047 patients presenting to the ED during the sampling frame). The majority of refusals reflect patients who reported feeling too sick, in too much pain, or too emotionally distressed to participate. Our IRB did not allow collecting additional information on missed or refused patients without consent.

Participants were eligible for the randomized controlled trial if they met at-risk drinking criteria based on either average consumption in the past three months (15 or more drinks/week for men under 65; 12 or more drinks/week for women under age 65 and men age 65 and over; and 9 or more drinks/week for women age 65 and over) or heavy drinking [5 or more drinks/occasion on at least four occasions in the last month (e.g., weekly heavy drinking) for men under age 65 and 4 or more drinks/occasion on at least four occasions in the past month for younger women (under age 65) and for men and women age 65 and over].

Among the 14.5% of patients ($n=649$) who screened positive for at-risk drinking, 89% ($n=575$) received a BI during their ED visit. The 74 patients who left the ED prior to receiving the BI are not described in this paper. Three and 12-month follow-up interview rates exceeded 85%; all subsequent data is for participants with complete follow-up data ($n=494$). Note that 90–95% (depending on 3- or 12-month interview) of follow-up data was obtained by phone; the remainder was obtained in person or by mail. Follow-up interviewers were blind to intervention condition assignment. BI participants were mostly male (71%), Caucasian (86%; 5.7% African-American, 8.3% other), never married (70%; 17% married), and college educated (80% at least some), with an average age of 27.8 (SD=11.2;

median=22; range=19–76). As indicated in Blow et al. (2006) no significant differences were found across the intervention groups in age ($F=0.47$, $df=3/490$, $p=.7066$), gender ($\chi^2=4.62$, $df=3$, $p=.2018$), marital status ($\chi^2=1.97$, $df=6$, $p=.92$), race/ethnicity ($\chi^2=1.06$, $df=6$, $p=.98$), or years of education ($\chi^2=3.02$, $df=9$, $p=.96$).

Measures

ED baseline screening was computerized with alcohol questions embedded in a health and lifestyle assessment that included questions concerning type and mechanism of current injury. The follow-up interview included identical questions to that of the baseline assessment.

Alcohol consumption questions included typical quantity (drinks per occasion) and frequency (days per week) of alcohol use in the past three months. A composite quantity/frequency score was calculated to reflect average weekly consumption. Heavy drinking was assessed by asking participants to indicate how frequently they consumed 4+/5+ drinks per occasion in the past month for men/women. The DrInc SIP was used to assess alcohol-related consequences (Miller et al., 1995). We added two items to reflect alcohol-related injuries and arrests for drinking and driving: “While drinking or intoxicated, I have been physically hurt, injured, or burned” and “I have been arrested for driving under the influence of alcohol.” This revised SIP retained the physical, social responsibility, intrapersonal, impulse control, and interpersonal consequence subscale scores as well as the total score, with adequate internal consistency (Cronbach’s $\alpha=.89-.90$).

Participants were asked whether they drank alcohol within 6 hours before their injury (yes/no) and whether they attributed their injury to alcohol use (yes, maybe, no). Regarding self-efficacy, participants rated how confident they were that they could control or abstain from drinking if they wanted to change their drinking habits on a five-point Likert scale (ranging from *not at all* to *extremely*). Readiness to change was assessed using two questions: “Do you plan to cut down on your drinking in the next 30 days?” (yes/no) and “Do you plan to cut down on your drinking in the next 6 months?” (yes/no). Based on these questions and previous algorithms used to categorize stage of change for substance use (e.g., Carey et al., 2002) participants were categorized into one of three stages: pre-contemplation (no plans to cut down or stop drinking in next six-months), contemplation (plans to cut down or stop drinking in next six months but not in next month), and action (plans to cut down or stop drinking in next month).

Intervention

During the advice session, the tailored or generic booklet was reviewed with the participant prior to discharge from the ED. Fidelity to intervention sessions was maintained via several strategies. A masters-level clinical supervisor “shadowed” therapists on a monthly basis to observe advice sessions and provide retraining as necessary. A psychologist trained in motivational interviewing conducted half-day training seminars twice yearly to review principles of motivational interviewing (e.g., rolling with resistance, developing discrepancy, etc.), including those encompassed in the FRAMES acronym (e.g., Feedback, Responsibility, Advice, Menu, Empathy, Self-Efficacy; Miller and Rollnick, 1991). All therapists had masters degrees in social work or related fields. For the no advice conditions, participants were told that, based on their responses to the health screen, they were at-risk for problem drinking and were given either a tailored or generic booklet to review.

Analyses

Analyses were conducted using SAS 9.1 statistical software. Descriptive analyses were conducted to examine variable distributions and determine the appropriateness of the

analytic approach (e.g., negative binomial distribution and a log link function for all outcome measures). The primary analysis strategy evaluated the effects of the intervention (advice, no advice) over the baseline, 3-month, and 12-month follow-up periods using generalized estimating equations (GEE) due to the correlated structure of our repeated measures (Liang & Zeger, 1986). Dependent variables included: average weekly alcohol consumption, frequency of heavy drinking in the past month, and consequences as measured by the DrInc (summary of all item responses).

Our prior paper (Blow et al., 2006) showed limited influence of tailoring as compared to generic booklets. As a result, for the purposes of examining moderators of treatment outcome, we limited our analyses to treatment effects comparing the advice and no advice conditions. This approach also provides a more powerful test of the main effects of the advice condition. Independent variables included advice (yes/no) and time (baseline, 3-months, 12-months). In addition, gender and age (≤ 22 and > 22) were included as covariates. Gender was included because the literature and our prior work (Blow et al., 2006) shows that BIs may be more effective for women than men. Age (median age 22) was included in the analyses because of the large proportion of college students in the sample and prior research from this study (Blow et al., 2006) showing differential effects of brief interventions based on age. Moderators of treatment outcome were examined via interactions for treatment condition by hypothesized moderator variable (drinking within 6 hours before injury, stage of change, attributed the injury to alcohol, and self-efficacy) by time. Models were constructed separately for the three drinking outcomes, with main effects (independent variables and moderators) and covariates entered on the first step, treatment by moderator interactions entered on the second step, time by moderator interactions entered on the third step, and three-way interactions (time by treatment by moderator) entered on the fourth step. Note that the size of the smallest subgroup for the categorical predictors used in the 3-way interaction analyses ($n=36$; for the no treatment by positive attribution of injury to alcohol), suggests the sample distribution was adequate for conducting these analyses. Thus, multivariate analyses examined evidence for significant changes over time in the outcome variables based on moderators of effectiveness for the advice/no advice conditions.

Results

Drinking Characteristics of the Sample and Attrition Analyses

On average, participants reported consuming 20.5 (SD = 16.8) drinks per week, had engaged in 7.1 (SD = 6.0) heavy drinking episodes in the past month, and endorsed 4.7 (SD = 5.5) drinking consequences at baseline. Participants lost to follow-up did not differ from complete cases on the following baseline measures: frequency of heavy drinking, alcohol-related negative consequences, stage of change, alcohol-related injury attributions, alcohol use within 6 hours before the injury, and gender. Those lost to follow-up had higher average consumption (26.3 vs. 20.5 drink per week, $p < 0.01$); were significantly older (79.0% of cases with missing data were over age 22 vs. 49.5% for complete cases, $p < 0.001$); and had lower self-efficacy for controlling or abstaining from drinking (4.2 vs. 4.5 on a 5-point scale, $p < 0.01$).

Descriptive Information for Moderators at Baseline

The majority of participants (53.4%) were classified in the precontemplation stage of change, whereas 8.7% were in contemplation and 37.9% were in action. Regarding self-efficacy, 89.9% indicated they were very or extremely confident they could cut down or stop drinking whereas 8.9% indicated they were somewhat confident and 1.2% indicated they were a little or not at all confident. Approximately one quarter (27.1%) of participants indicated they drank within 6 hours before their injury and 15.6% perceived their injury to

be related to alcohol use. Table 1 shows descriptive data for change in the alcohol-related dependent variables (i.e., quantity/frequency, heavy drinking, and DrInC consequences) over time, based on the moderator variables, and associated individual significance levels. Note that for most levels of the moderator variables, quantity/frequency, heavy drinking, and DrInC consequences significantly decreased over the follow-up period.

Moderators of Intervention Outcomes

Average Consumption—First, we examined the main effects of the moderator variables on average weekly consumption over time. Overall, average weekly consumption decreased over time ($\chi^2 = 97.2$, $df = 2$, $p < .001$) and was lower among women than among men ($\chi^2 = 51.0$, $df = 1$, $p < .001$). In addition, there were significant main effects for self-efficacy ($\chi^2 = 10.3$, $df = 1$, $p < 0.01$) and readiness to change ($\chi^2 = 24.7$, $df = 1$, $p < .001$). Specifically, participants who reported higher levels of self-efficacy had lower weekly consumption whereas those with higher readiness to change had greater weekly consumption. Baseline age over 22 ($\chi^2 = 0.1$, $df = 1$, $p = 0.718$), alcohol use within 6 hours before injury ($\chi^2 = 0.9$, $df = 1$, $p = 0.331$) and alcohol-related injury attributions ($\chi^2 = 3.2$, $df = 1$, $p = 0.074$) were not significantly associated with alcohol consumption. Second, we examined two-way interactions between treatment moderators and time, and between treatment moderators and intervention type; these findings were not significant and are not presented. Third, we examined all three-way interactions [treatment x time x moderator (self-efficacy, readiness to change, alcohol-related injury attributions, and alcohol use within 6 hours before injury)] and only one significant three-way interaction was identified: alcohol attribution, treatment, and time ($\chi^2 = 7.9$, $df = 2$, $p < .05$). Individuals who attributed their injury to alcohol and received advice had significantly lower levels of average weekly alcohol consumption from baseline to 12-month follow-up compared to those who attributed their injury to alcohol but did not receive advice (see Figure 1). Further, as shown in Table 2, participants in the advice condition who attributed their injury to alcohol showed a 44.6% change in mean average consumption from baseline to 12-months, as compared to a 16.7% change in consumption in the no advice by alcohol attribution group.

Heavy Drinking—First, we examined main effects over time and found significant effects for the following variables: age, gender, self-efficacy, and stage of change (see Table 1 for descriptive data). Overall, heavy drinking decreased over time ($\chi^2 = 69.3$ $df = 2$, $p < .001$). Women reported fewer episodes of heavy drinking than men ($\chi^2 = 6.0$ $df = 1$, $p < .05$); participants who were older than 22 years old ($\chi^2 = 19.2$, $df = 1$, $p < .001$) and those with greater self-efficacy ($\chi^2 = 10.9$, $df = 1$, $p < .001$) had fewer heavy drinking episodes. In addition, participants who reported greater readiness to change reported more frequent heavy drinking in the past month ($\chi^2 = 38.6$, $df = 1$, $p < .001$). There were no significant main effects for attributions for the ED-related incident ($\chi^2 = 3.3$, $df = 1$, $p = 0.071$) or alcohol use within 6 hours before injury ($\chi^2 = 0.7$, $df = 1$, $p = 0.401$). Second, there were no significant two-way interactions between the moderator variables and treatment condition or time. Third, regarding all possible three-way interactions tested, there was a significant three-way interaction for alcohol attribution, advice condition, and time ($\chi^2 = 6.6$, $df = 2$, $p < .05$). Specifically, individuals who attributed their injury to alcohol and received advice had significantly fewer heavy drinking episodes than participants who attributed their injury to alcohol, but did not receive advice (see Figure 2). Further, as shown in Table 3, participants in the advice condition who attributed their injury to alcohol showed a 50.5% change in mean heavy drinking episodes from baseline to 12-months as compared to a 13.2% change in the no advice by alcohol attribution group.

Alcohol Consequences: DrInc—First, we examined main effects over time and found that negative consequences decreased over time ($\chi^2 = 39.7$, $df = 2$, $p < .001$) and women

reported experiencing fewer consequences than men ($\chi^2 = 13.3$, $df = 1$, $p < .001$). In addition, those with greater self-efficacy reported fewer consequences ($\chi^2 = 19.4$, $df = 1$, $p < .001$). Conversely, participants who attributed their injury to alcohol reported a greater number of consequences compared to those who did not make alcohol-related attributions ($\chi^2 = 16.6$, $df = 1$, $p < .001$) and those who reported greater readiness to change also had a greater number of consequences ($\chi^2 = 87.3$, $df = 1$, $p < .001$). There were no main effects of age ($\chi^2 = 2.9$, $df = 1$, $p = 0.087$) or alcohol use within 6 hours before injury on drinking consequences ($\chi^2 = 1.2$, $df = 1$, $p = 0.282$). Second, none of the possible two-way or three-way interactions tested reached significance, indicating that there were no significant moderators of treatment or time on negative consequences of drinking.

Discussion

This paper provides important information regarding moderators of the effectiveness of brief alcohol interventions in an ED setting. To our knowledge, there have been very few prior papers to examine this issue in any setting despite the call from researchers to identify the essential components of brief alcohol interventions (Burke et al., 2003). Identification of moderators provides preliminary data regarding the mechanisms of change and has important implications for focusing future brief alcohol interventions in the ED in order to augment the effectiveness of these interventions. Overall, our findings suggest that BIs may be particularly effective for individuals who attribute their injury to alcohol.

Furthermore, attributing the current injury to alcohol appears to maintain the efficacy of the BI, with these effects being most pronounced one year after the ED visit. Prior ED research of BIs has typically evaluated outcomes at a single follow-up period. For example, some studies have only published short-term (e.g., 3- or 6-months) outcomes (Bazargan-Hejazi et al., 2005; Monti et al., 1999) whereas other studies have only published longer-term (e.g., 12-month) outcomes (Gentilello et al., 1999; Longabaugh et al., 2001; Mello et al., 2005). Among ED studies with multiple follow-up periods, one study (Gentilello et al., 1999) found BI effects were more pronounced at one-year than six-months due to increases in drinking and injury in the control group; however, another study found BI effects were more robust at 6-months than 12-months (Neumann et al., 2006). These discrepancies may result from variations in the impact and extent of the control condition. For example, it may be that an ED visit for injury attenuates drinking among control participants; however, these effects may not be maintained over the long-term with drinking (or injury) returning to baseline levels by 12-months. In contrast, reductions in drinking among intervention subgroups (such as those making a connection between their drinking and their injury) may be maintained over the long-term, with one study showing lasting effects on injury at 3-years (Gentilello et al., 1999). Future research with multiple, long-term follow-ups are required to test these suppositions.

Researchers have theorized that BIs are effective when delivered during a health care visit due to the notion of a “teachable moment” during which patients may be more receptive to feedback regarding their drinking, particularly when delivered in the context of an empowering, non-confrontational motivational interview. Findings from this study suggest that participants who attributed their injury to drinking initially had significant reductions in alcohol use, regardless of intervention type, but that longer-term reductions for these participants were best achieved via therapist-delivered BIs. In addition, actual alcohol use within 6 hours before the injury was not related to intervention effectiveness whereas the individual’s perception that alcohol caused the injury was related to intervention effectiveness. Indeed, a recent study found that alcohol attribution was not simply a function of amount of alcohol consumed and feeling drunk, but was influenced by usual drinking pattern and cultural context (Cherpitel et al., 2006a). Further, our findings are consistent

with Barnett et al. (2006) who found that drinking history was associated with reduced motivation to change among individuals who were mandated to a BI following an alcohol-related incident, whereas aversiveness of the incident was associated with greater motivation. Sanchez-Craig (1990) has suggested that the effectiveness of BIs result from increasing responsibility for drinking. The present findings are consistent with this notion and suggest that attribution of injury to alcohol is a piece of information that therapists may use to develop a discrepancy between current behaviors and health and social goals, and tip the decisional balance in favor of consideration of reducing or stopping alcohol misuse. When an individual does not perceive his/her injury as alcohol-related, it might be an important target of the initial MI intervention. That is, heightening awareness regarding the relationship between alcohol and injury may increase the effectiveness of the intervention; if the connection between the current injury and alcohol use is not relevant, the relationship between past or future injuries and alcohol use could be discussed.

In addition, although pre-intervention self-efficacy and readiness to change were unrelated to intervention outcomes over time, further research is needed to determine whether BIs impact stage of change. Assessing stage of change immediately following the intervention would provide a more precise assessment of changes in stage of change as moderators of intervention outcome. We found that prior to the intervention, higher self-efficacy was associated with lower levels of alcohol use and fewer negative consequences whereas higher stage of change was associated with higher levels of alcohol use and more negative consequences. Regarding self-efficacy, it appears that those with higher levels of self-efficacy are indeed successful at maintaining lower levels of alcohol use and consequences, regardless of specific interventions. Conversely, those who are consuming alcohol at higher levels may be more likely to endorse readiness to change, but this has little impact on actual intervention response. It appears that stage of change as measured in this study reflects baseline problem severity, with precontemplators showing lower levels of drinking and consequences, and less interest in changing drinking, than other groups. These findings are consistent with others who have found a positive relationship between stage of change and alcohol use (Leontieva et al., 2005; Shealy et al., 2007).

There are several limitations of this study that must be noted. The site of the study was a suburban University-affiliated ED, which serves a highly educated, mostly Caucasian population. Replication is required in ED settings serving more diverse patient populations and should include admitted patients, pregnant women, suicidal patients, and patients presenting for sexual assault. In addition, as participant recruitment of injured patients occurred between the hours of 08:00 and 24:00, results may not generalize to injured patients presenting on midnight shifts or to patients presenting with medical complaints. Although the omission of a true control condition was based on extensive research demonstrating the effectiveness of BIs for alcohol, the enhanced usual care condition (i.e., no advice + generic booklet) precludes direct comparison of findings to a no intervention condition. Given the time constraints in a busy ED setting, it was not feasible to include several multi-item scales in the assessment. In addition, self-efficacy and stage of change were not measured immediately after the intervention; implementation of post-tests should be conducted to further examine these variables as potential moderators. Although the follow-up rate was excellent (85%), it is possible that findings were biased due to attrition. Future studies are needed to replicate our findings with established measures (e.g. rulers for stage of change, self-efficacy) and to expand the type of moderators examined (e.g., therapeutic alliance). Finally, future studies should assess the timing of the brief intervention relative to length of time in the ED to determine whether this impacts intervention effectiveness.

Despite these limitations, this paper provides novel information regarding potential moderators of the effectiveness of brief alcohol interventions in the ED. Findings suggest that BIs may reduce drinking outcomes via identification of the link between alcohol and injury, and suggest that interventions focusing on increasing change talk in this regard may improve outcomes and reduce future injuries. In addition, interventions aimed at supporting self-efficacy may be particularly important for reducing alcohol use. These suggestions are consistent with a motivational interviewing philosophy and framework, but staff delivering these interventions require training and supervision to master these techniques. Given time and caseload pressures facing physicians in the fast-paced ED setting, it may be most beneficial and cost-effective to train other health care providers (e.g., social workers as used in the present study, nurses, mental health workers) to deliver BIs. Findings from this study shed some light on the “black box” of brief alcohol interventions that may assist clinicians and researchers in streamlining and increasing the potency of these approaches.

Acknowledgments

This project was supported by a grant (#AA11629) from the National Institute on Alcoholism and Alcohol Abuse (NIAAA). We would like to thank Lynn Massey, Scott Kelly, Robert Vaidya, Harpreet Otal, Margaret White, and Robin Williams for their work on this project.

References

- Babor, TF.; Grant, M. Report on Phase II: A randomized clinical trial of brief interventions in primary health care. World Health Organization; 1992.
- Barnett NP, Goldstein AL, Murphy JG, Colby SM, Monti PM. “I’ll never drink like that again”: characteristics of alcohol-related incidents and predictors of motivation to change in college students. *J Stud Alcohol*. 2006; 67:754–63. [PubMed: 16847545]
- Barry, KL. Brief Interventions and Brief Therapies for Substance Abuse. U.S. Department of Health and Human Services, Public Health Service, Substance Abuse and Mental Health Services Administration, Center for Substance Abuse Treatment; 1999.
- Bazargan-Hejazi S, Bing E, Bazargan M, Der-Martirosian C, Hardin E, Bernstein J, Bernstein E. Evaluation of a brief intervention in an inner-city emergency department. *Ann Emerg Med*. 2005; 46:67–76. [PubMed: 15988430]
- Bien TH, Miller WR, Tonigan JS. Brief interventions for alcohol problems: a review. *Addiction*. 1993; 88:315–35. [PubMed: 8461850]
- Blow FC, Barry KL, Walton MA, Maio RF, Chermack ST, Bingham CR, Ignacio RV, Strecher VJ. The efficacy of two brief intervention strategies among injured, at-risk drinkers in the emergency department: impact of tailored messaging and brief advice. *J Stud Alcohol*. 2006; 67:568–78. [PubMed: 16736077]
- Blume AW, Schmaling KB, Marlatt AG. Predictors of change in binge drinking over a 3-month period. *Addict Behav*. 2003; 28:1007–12. [PubMed: 12788273]
- Burke BL, Arkowitz H, Menchola M. The efficacy of motivational interviewing: a meta-analysis of controlled clinical trials. *J Consult Clin Psychol*. 2003; 71:843–61. [PubMed: 14516234]
- Carey KB, Purnine DM, Maisto SA, Carey MP. Correlates of stages of change for substance abuse among psychiatric outpatients. *Psychol Addict Behav*. 2002; 16:283–9. [PubMed: 12503900]
- Cherpitel CJ. Alcohol consumption and casualties: a comparison of two emergency room populations. *Br J Addict*. 1988a; 83:1299–307. [PubMed: 3266084]
- Cherpitel CJ. Drinking patterns and problems associated with injury status in emergency room admissions. *Alcohol Clin Exp Res*. 1988b; 12:105–10. [PubMed: 3279840]
- Cherpitel CJ. Breath analysis and self-reports as measures of alcohol-related emergency room admissions. *J Stud Alcohol*. 1989; 50:155–61. [PubMed: 2927129]
- Cherpitel CJ. Alcohol and injuries: a review of international emergency room studies. *Addiction*. 1993a; 88:923–37. [PubMed: 8358264]

- Cherpitel CJ. Alcohol and violence-related injuries: an emergency room study. *Addiction*. 1993b; 88:79–88. [PubMed: 8448517]
- Cherpitel CJ. Alcohol, injury, and risk-taking behavior: data from a national sample. *Alcohol Clin Exp Res*. 1993c; 17:762–6. [PubMed: 8214410]
- Cherpitel CJ. Alcohol and injuries resulting from violence: a comparison of emergency room samples from two regions of the U.S. *J Addict Dis*. 1997; 16:25–40. [PubMed: 9046443]
- Cherpitel CJ. Drinking Patterns and Problems: A Comparison of Primary Care with the Emergency Room. *Subst Abus*. 1999; 20:85–95. [PubMed: 12511823]
- Cherpitel CJ, Bond J, Ye Y, Borges G, Room R, Poznyak V, Hao W. Multi-level analysis of causal attribution of injury to alcohol and modifying effects: Data from two international emergency room projects. *Drug Alcohol Depend*. 2006a; 82:258–68. [PubMed: 16257137]
- Cherpitel CJ, Ye Y, Bond J, Rehm J, Cremona M, Neves O, Moskalewicz J, Swiatkiewicz G, Giesbrecht N. The effect of alcohol consumption on emergency department services use among injured patients: A cross-national emergency room study. *J Stud Alcohol*. 2006b; 67:890–7. [PubMed: 17061006]
- Cherpitel CJ, Ye Y, Bond J, Rehm J, Poznyak V, Macdonald S, Stafstrom M, Hao W. Emergency Room Collaborative Alcohol Analysis Project (ERCAAP) and the WHO Collaborative Study on Alcohol and Injuries. Multi-level analysis of alcohol-related injury among emergency department patients: a cross-national study. *Addiction*. 2005 Dec.100(12):1840, 50. [PubMed: 16367985]
- Conigrave KM, Burns FH, Reznik RB, Saunders JB. Problem drinking in emergency department patients: the scope for early intervention. *Med J Aust*. 1991; 154:801–5. [PubMed: 2041505]
- Dowey KE. Alcohol-related attendances at an accident and emergency department. *Ulster Med J*. 1993; 62:58–62. [PubMed: 8516977]
- Dunn C, Deroo L, Rivara FP. The use of brief interventions adapted from motivational interviewing across behavioral domains: a systematic review. *Addiction*. 2001; 96:1725–42. [PubMed: 11784466]
- Fleming MF, Balousek SL, Klessig CL, Mundt MP, Brown DD. Substance use disorders in a primary care sample receiving daily opioid therapy. *J Pain*. 2007; 8:573–82. [PubMed: 17499555]
- Fleming MF, Barry KL, Manwell LB, Johnson K, London R. Brief physician advice for problem alcohol drinkers. A randomized controlled trial in community-based primary care practices. *Jama*. 1997; 277:1039–45. [PubMed: 9091691]
- Fleming MF, Manwell LB, Barry KL, Adams W, Stauffacher EA. Brief physician advice for alcohol problems in older adults: a randomized community-based trial. *J Fam Pract*. 1999; 48:378–84. [PubMed: 10334615]
- Fleming MF, Mundt MP, French MT, Manwell LB, Stauffacher EA, Barry KL. Brief physician advice for problem drinkers: long-term efficacy and benefit-cost analysis. *Alcohol Clin Exp Res*. 2002; 26:36–43. [PubMed: 11821652]
- Gentilello LM. Alcohol interventions in trauma centers: the opportunity and the challenge. *J Trauma*. 2005; 59:S18–20. [PubMed: 16355055]
- Gentilello LM, Rivara FP, Donovan DM, Jurkovich GJ, Daranciang E, Dunn CW, Villaveces A, Copass M, Ries RR. Alcohol interventions in a trauma center as a means of reducing the risk of injury recurrence. *Ann Surg*. 1999; 230:473–80. discussion 480–3. [PubMed: 10522717]
- Gregor MA, Shope JT, Blow FC, Maio RF, Weber JE, Nypaver MM. Feasibility of using an interactive laptop program in the emergency department to prevent alcohol misuse among adolescents. *Ann Emerg Med*. 2003; 42:276–84. [PubMed: 12883517]
- Heather N, Rollnick S, Bell A, Richmond R. Effects of brief counselling among male heavy drinkers identified on general hospital wards. *Drug Alcohol Rev*. 1996; 15:29–38. [PubMed: 16203349]
- Hingson R, Howland J. Alcohol as a risk factor for injury or death resulting from accidental falls: a review of the literature. *Journal of Studies on Alcohol*. 1987; 48:212–19. [PubMed: 3309468]
- Hingson RW, Lederman RI, Walsh DC. Employee drinking patterns and accidental injury: a study of four New England states. *J Stud Alcohol*. 1985; 46:298–303. [PubMed: 4033130]
- Ilgen M, Tiet Q, Finney J, Moos RH. Self-efficacy, therapeutic alliance, and alcohol-use disorder treatment outcomes. *J Stud Alcohol*. 2006; 67:465–72. [PubMed: 16608158]
- International Classification of Diseases. Practice Management Corporation; 1995.

- Johnston BD, Rivara FP, Droesch RM, Dunn C, Copass MK. Behavior change counseling in the emergency department to reduce injury risk: a randomized, controlled trial. *Pediatrics*. 2002; 110:267–74. [PubMed: 12165577]
- Kerr MH, Campbell FC, Rutherford WH. Unemployment, alcohol and injury in west Belfast. *Injury*. 1987; 18:313–14. [PubMed: 3508873]
- Kunz FM Jr, French MT, Bazargan-Hejazi S. Cost-effectiveness analysis of a brief intervention delivered to problem drinkers presenting at an inner-city hospital emergency department. *J Stud Alcohol*. 2004; 65:363–70. [PubMed: 15222593]
- Leontieva L, Horn K, Haque A, Helmkamp J, Ehrlich P, Williams J. Readiness to change problematic drinking assessed in the emergency department as a predictor of change. *J Crit Care*. 2005; 20:251–6. [PubMed: 16253794]
- Li G, Keyl PM, Rothman R, Chanmugam A, Kelen GD. Epidemiology of alcohol-related emergency department visits. *Acad Emerg Med*. 1998; 5:788–95. [PubMed: 9715240]
- Liang KY, Zeger SL. Longitudinal data analysis using generalized linear models. *Biometrika*. 1986; 73:13–22.
- Longabaugh R, Woolard RE, Nirenberg TD, Minugh AP, Becker B, Clifford PR, Carty K, Licsw, Sparadeo F, Gogineni A. Evaluating the effects of a brief motivational intervention for injured drinkers in the emergency department. *J Stud Alcohol*. 2001; 62:806–16. [PubMed: 11838918]
- Macdonald S, Wells S, Giesbrecht N, Cherpitel CJ. Demographic and substance use factors related to violent and accidental injuries: results from an emergency room study. *Drug Alcohol Depend*. 1999; 55:53–61. [PubMed: 10402149]
- Maio RF. Alcohol and injury in the emergency department: opportunities for intervention. *Annals of Emergency Medicine*. 1995; 26:221–223. [PubMed: 7618788]
- Maio RF, Waller PF, Blow FC, Hill EM, KMS. Alcohol abuse/dependence in motor vehicle crash victims presenting to the emergency department. *Academic Emergency Medicine*. 1997; 4:256–262. [PubMed: 9107322]
- Maisto SA, Conigliaro J, Mcneil M, Kraemer K, Conigliaro RL, Kelley ME. Effects of two types of brief intervention and readiness to change on alcohol use in hazardous drinkers. *J Stud Alcohol*. 2001; 62:605–14. [PubMed: 11702799]
- Mccaig LF, Burt CW. National Hospital Ambulatory Medical Care Survey: 1999 emergency department summary. *Adv Data*. 2001:1–34. [PubMed: 12666256]
- Mccaig LF, Burt CW. National Hospital Ambulatory Medical Care Survey: 2001 emergency department summary. *Adv Data*. 2003:1–29. [PubMed: 12822264]
- Mckay JR, Maisto SA, O'farrell TJ. End-of-treatment self-efficacy, aftercare, and drinking outcomes of alcoholic men. *Alcohol Clin Exp Res*. 1993; 17:1078–83. [PubMed: 8279669]
- Mello MJ, Nirenberg TD, Longabaugh R, Woolard R, Minugh A, Becker B, Baird J, Stein L. Emergency department brief motivational interventions for alcohol with motor vehicle crash patients. *Ann Emerg Med*. 2005; 45:620–5. [PubMed: 15940095]
- Melnick DM, Maio RF, Blow FC, Hill EM. Does acute alcohol ingestion and/or chronic alcohol use among motor vehicle crash victims lead to a more complicated hospital course? *Annu Proc Assoc Adv Automot Med*. 2000; 44:429–43. [PubMed: 11558099]
- Miller, WR.; Rollnick, S. Preparing people to change addictive behavior. New York: The Guilford Press; 1991. Motivational Interviewing.
- Miller, WR.; Rollnick, S. Motivational interviewing: preparing people for change. 2. New York, NY: The Guilford Press; 2002.
- Miller, WR.; Tonigan, JS.; Longbaugh, R. The Drinker Inventory of Consequences (DrInc): An instrument for assessing adverse consequences of alcohol abuse. 1995.
- Monti, PM.; Barnett, NP.; Colby, SM.; O'leary, TA. Motivational enhancement of alcohol-involved adolescents. In: Monti, PM.; Colby, SM.; O'Leary, TA., editors. *Adolescents, Alcohol and Substance Abuse*. New York, NY: The Guilford Press; 2001a. p. 145-182.
- Monti PM, Colby SM, Barnett NP, Spirito A, Rohsenow DJ, Myers M, Woolard R, Lewander W. Brief intervention for harm reduction with alcohol-positive older adolescents in a hospital emergency department. *J Consult Clin Psychol*. 1999; 67:989–94. [PubMed: 10596521]

- Monti PM, Rohsenow DJ, Swift RM, Gulliver SB, Colby SM, Mueller TI, Brown RA, Gordon A, Abrams DB, Niaura RS, Asher MK. Naltrexone and cue exposure with coping and communication skills training for alcoholics: treatment process and 1-year outcomes. *Alcohol Clin Exp Res*. 2001b; 25:1634–47. [PubMed: 11707638]
- Neumann T, Neuner B, Weiss-Gerlach E, Tonnesen H, Gentilello LM, Wernecke KD, Schmidt K, Schroder T, Wauer H, Heinz A, Mann K, Muller JM, Haas N, Kox WJ, Spies CD. The Effect of Computerized Tailored Brief Advice on At-risk Drinking in Subcritically Injured Trauma Patients. *J Trauma*. 2006; 61:805–814. [PubMed: 17033544]
- Perrine, MW.; Peck, RC.; Fell, JC. Epidemiologic perspectives on drunk driving (Surgeon General's Workshop on Drunk Driving: Background Papers). Department of Health and Human Services; 1989.
- Poikolainen K. Effectiveness of brief interventions to reduce alcohol intake in primary health care populations: a meta-analysis. *Prev Med*. 1999; 28:503–9. [PubMed: 10329341]
- Prochaska JO, Diclemente CC. Stages and processes of self-change of smoking: toward an integrative model of change. *J Consult Clin Psychol*. 1983; 51:390–5. [PubMed: 6863699]
- Rivara FP, Jurkovich GJ, Gurney JG, Seguin D, Fligner CL, Ries R, Raisys VA, Copass M. The magnitude of acute and chronic alcohol abuse in trauma patients. *Arch Surg*. 1993; 128:907–12. discussion 912–3. [PubMed: 8102049]
- Sanchez-Craig M. Brief didactic treatment for alcohol and drug-related problems: an approach based on client choice. *Br J Addict*. 1990; 85:169–77. [PubMed: 2317584]
- Shealy AE, Murphy JG, Borsari B, Correia CJ. Predictors of motivation to change alcohol use among referred college students. *Addict Behav*. 2007; 32:2358–64. [PubMed: 17398012]
- Soderstrom CA, Dischinger PC, Smith GS, Hebel JR, Mcduff DR, Gorelick DA, Kerns TJ, Ho SM, Read KM. Alcoholism at the time of injury among trauma center patients: vehicular crash victims compared with other patients. *Accid Anal Prev*. 1997a; 29:715–21. [PubMed: 9370007]
- Soderstrom CA, Smith GS, Dischinger PC, Mcduff DR, Hebel JR, Gorelick DA, Kerns TJ, Ho SM, Read KM. Psychoactive substance use disorders among seriously injured trauma center patients. *Jama*. 1997b; 277:1769–74. [PubMed: 9178789]
- Soderstrom CA, Trifillis AL, Shankar BS, Clark WE, Cowley RA. Marijuana and alcohol use among 1023 trauma patients. A prospective study. *Arch Surg*. 1988; 123:733–7. [PubMed: 2835941]
- Welte JW, Perry P, Longabaugh R, Clifford PR. An outcome evaluation of a hospital-based early intervention program. *Addiction*. 1998; 93:573–81. [PubMed: 9684395]

Figure 1. Interaction effect between perception of alcohol / injury attribution and Advice Condition on Average Weekly Consumption. ($\chi^2 = 7.9$, $df = 2$, $p < .05$).

Figure 2. Interaction effect between perception of alcohol / injury attribution and Advice Condition with Heavy Drinking. ($\chi^2 = 6.6$, $df = 2$, $p < .05$).

Table 1

Mean (SD) quantity/frequency, heavy drinking, and DrInC consequences for moderator variables by follow-up ($N = 494$).

Moderator Variable	Baseline	3-months	12-months	p-value
Quantity/Frequency				
Stage of Change				
Precontemplation	18.5 (16.1)	11.4 (10.5)	10.6 (11.0)	<0.0001
Contemplation	21.8 (15.5)	14.8 (13.7)	17.3 (11.5)	n.s.
Preparation/Action	23.0 (17.8)	18.0 (15.6)	15.6 (12.8)	<0.0001
Drink w/in 6 hours before injury				
Yes	23.2 (19.8)	16.9 (16.4)	15.6 (15.2)	<0.0001
No	19.5 (15.5)	13.0 (11.5)	12.4 (10.4)	<0.0001
Self-efficacy				
Low (Not at all- Moderate)	32.9 (24.0)	21.6 (22.4)	16.8 (11.9)	n.s.
High (Very – Extremely)	19.1 (15.2)	13.2 (11.4)	12.7 (11.9)	<0.0001
Attribute injury to alcohol				
Yes	25.3 (21.1)	19.7 (18.8)	17.8 (18.5)	<0.05
No	19.6 (15.8)	13.0 (11.5)	12.4 (10.2)	<0.0001
Heavy Drinking				
Stage of Change				
Precontemplation	6.0 (5.3)	3.9 (4.6)	3.7 (4.6)	<0.0001
Contemplation	8.6 (7.4)	5.9 (6.6)	8.3 (7.1)	n.s.
Preparation/Action	8.3 (6.4)	6.2 (6.1)	5.6 (5.7)	<0.0001
Drink w/in 6 hours before injury				
Yes	8.7 (6.7)	6.3 (6.2)	6.1 (6.2)	<0.0001
No	6.5 (5.6)	4.4 (5.1)	4.6 (5.3)	<0.0001
Self-efficacy				
Low (Not at all- Moderate)	10.1 (7.9)	6.9 (7.9)	6.6 (7.0)	n.s.
High (Very – Extremely)	6.7 (5.7)	4.7 (5.2)	4.8 (5.4)	<0.0001
Attribute injury to alcohol				
Yes	10.0 (7.0)	7.5 (6.8)	6.8 (5.9)	<0.001
No	6.6 (5.7)	4.4 (5.1)	4.7 (5.5)	<0.0001
DrInC Consequences				
Stage of Change				
Precontemplation	3.4 (4.0)	2.3 (3.7)	1.9 (2.8)	<0.0001
Contemplation	7.5 (5.9)	3.9 (3.5)	3.9 (3.6)	n.s.
Preparation/Action	7.9 (7.7)	7.1 (8.1)	6.9 (8.1)	<0.001
Drink w/in 6 hours before injury				
Yes	8.7 (7.9)	5.5 (7.3)	5.4 (7.8)	<0.0001
No	4.2 (5.0)	3.5 (5.3)	3.3 (4.5)	<0.01
Self-efficacy				
Low (Not at all- Moderate)	13.6 (10.1)	9.2 (11.0)	7.5 (8.2)	<0.05

Moderator Variable	Baseline	3-months	12-months	p-value
Quantity/Frequency				
High (Very – Extremely)	4.5 (4.9)	3.5 (4.8)	3.3 (5.1)	<0.0001
Attribute injury to alcohol				
Yes	12.0 (9.1)	7.9 (10.3)	7.1 (9.6)	<0.0001
No	4.2 (4.7)	3.4 (4.4)	3.3 (4.5)	<0.0001

Table 2

Average Weekly Consumption: Means by Follow-up and Alcohol/Injury Attribution by Advice Interaction.

Follow-up	Alcohol / Injury Attribution, Mean (SD)			
	Yes Attribution Advice (n = 41)	No Attribution Advice (n = 212)	Yes Attribution No Advice (n = 36)	No Attribution No Advice (n = 205)
Baseline	23.3 (19.3)	20.6 (17.4)	27.5 (23.1)	18.6 (13.9)
3-months	22.3 (23.6)	13.5 (11.6)	16.7 (10.5)	12.4 (11.3)
12-months	12.9 (11.9)	12.6 (9.6)	22.9 (22.7)	12.1 (10.8)
Baseline to 12-mo				
Difference in Mean	-10.4	-8.0	-4.6	-6.5
% Change in Mean	-44.6	-38.8	-16.7	-34.9
Sign test p-value	.024	<.001	.585	<.001

Table 3

Heavy Drinking: Means by Follow-up and Alcohol/Injury Attribution by Advice Interaction.

Follow-up	Alcohol / Injury Attribution, Mean (SD)			
	Yes Attribution Advice (n = 41)	No Attribution Advice (n = 212)	Yes Attribution No Advice (n = 36)	No Attribution No Advice (n = 205)
Baseline	9.3 (6.5)	6.7 (5.5)	10.6 (7.5)	6.4 (5.9)
3-months	8.0 (8.0)	4.6 (4.8)	7.0 (5.0)	4.1 (5.4)
12-months	4.6 (4.5)	5.1 (5.4)	9.2 (6.4)	4.2 (5.5)
Baseline to 12-mo				
Difference in Mean	-4.7	-1.6	-1.4	-2.2
% Change in Mean	-50.5	-23.9	-13.2	-34.4
Sign test p-value	.007	<.001	.136	<.001