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Impact of a brief intervention on reducing alcohol use and increasing alcohol treatment services utilization among alcohol- and drug-using adult emergency department patients

Roland C. Merchant, MD, MPH, ScD^{1,2}, Justin Romanoff, MA³, Zihao Zhang, MSc³, Tao Liu, PhD³, and Janette R. Baird, PhD¹

¹Department of Emergency Medicine, Alpert Medical School, Brown University

²Department of Epidemiology, School of Public Health, Brown University

³Department of Biostatistics, Center for Statistical Sciences, School of Public Health, Brown University

Abstract

Most previous brief intervention (BI) studies have focused on alcohol or drug use, instead of both substances. Our primary aim was to determine if an alcohol and drug use BI reduced alcohol use and increased alcohol treatment services utilization among adult emergency department (ED) patients. Our secondary aims were to assess when the greatest relative reductions in alcohol use occurred, and which patients (stratified by need for an alcohol use intervention) reduced their alcohol use the most. We studied a sub-sample of participants from a randomized, controlled trial of a BI vs. no BI whose responses to the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) indicated a need for a BI for any drug use and who also reported alcohol use. Participants were stratified by their ASSIST alcohol subscore: (1) no BI needed, (2) a BI needed, or (3) an intensive intervention needed for alcohol use. Alcohol use and alcohol treatment services utilization were measured every three months for 12 months post-enrollment. Of these 833 participants, median age was 29 years-old, 46% were female; 55% were white/non-Hispanic, 27% black/non-Hispanic and 15% Hispanic. Although any alcohol use, alcohol use frequency, days of alcohol use, typical drinks consumed/day, and most drinks consumed/day decreased in both the BI and no BI arms, there were no differences between study arms. Few patients sought alcohol use treatment services in follow-up, and utilization also did not differ by study arm. Compared to baseline, alcohol use reduced the most during the first three months after enrollment, yet reduced little afterwards. Participants whose ASSIST alcohol subscores indicated a need for an intensive intervention generally had the greatest relative decreases in alcohol use. These results indicate that the BI used was not efficacious in reducing alcohol use among alcohol- and drug-using adult ED patients. There is a need to develop and test more robust interventions.

Address for correspondence: Roland C. Merchant, MD, MPH, ScD, Department of Emergency Medicine, Rhode Island Hospital, 593 Eddy Street, Claverick Building Providence, RI 02903, rmerchant@lifespan.org.

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Introduction

Previous studies have reported that many adult emergency department (ED) patients who need treatment for their alcohol or drug use do not receive it, (Rockett, Putnam, Jia, & Smith, 2003) and barriers such as lack of access, insurance, motivation and standard protocols impede referrals to outpatient services after an ED visit. (Kyriacou, Handel, Stein, & Nelson, 2005; Pullen & Oser, 2014; Schuur et al., 2011) Brief interventions (BIs) conducted in the ED setting are one suggested remedy to filling this gap in care need. (Babor et al., 2007) ED-based BIs for alcohol use have shown efficacy in some studies, (Academic, 2010; Bazargan-Hejazi et al., 2005; Bernstein et al., 2010; D'Onofrio et al., 2012; Longabaugh et al., 2001; Mello et al., 2013) but not in others. (Landy, Davey, Quintero, Pecora, & McShane, 2016; Nilsen et al., 2008) ED-based (Bogenschutz et al., 2014; Woodruff et al., 2014) and outpatient BIs (Roy-Byrne et al., 2014; Saitz et al., 2014) for drug use have not been efficacious, at least not as previously attempted. In a previous randomized, controlled trial evaluating a BI for adult ED patients in need of an intervention for their drug use (per World Health Organization (WHO) criteria), (Humeniuk, 2010) we also found that participants who received an alcohol and drug use BI did not decrease their drug use more than those in an assessment only condition (completed questionnaires but did not receive a BI). (Merchant, Baird, & Liu, 2015)

Other limitations of previous ED-based BI studies are that BIs are focused either primarily or exclusively on alcohol or drug use, the populations studied were predominately alcohol or drug users, and the outcomes measured were restricted to either alcohol or drug use (as opposed to alcohol and drug use). In contrast to these separations, concurrent alcohol and drug use is common, particularly among adult ED patients. (Macias Konstantopoulos et al., 2014; Wu et al., 2012) A recent commentary about the lack of efficacy of a drug use BI in the outpatient setting called for research investigating the impact on concurrent alcohol and drug use. (Hingson & Compton, 2014) Given the co-occurrence of alcohol and drug use problems among adult ED patients, investigations of the impact of interventions on alcohol as well as drug use among those who use alcohol and drugs also are needed in the emergency medicine setting.

The primary aim of this current investigation was to determine if a BI provided to alcohol- and drug- using adult ED patients reduced alcohol use and increased alcohol treatment services utilization over a 12- month follow-up period more than no BI (assessment/questionnaires only). Participants in this investigation constituted a sub-population from our previous trial who required an intervention for their drug use (per WHO criteria) who also reported alcohol use, stratified by their need for no BI, a BI or an intensive intervention for their alcohol use (per WHO criteria). Our secondary aims were to assess when the greatest relative reductions in alcohol use occurred over time during follow-up, and which patients (stratified by need for an alcohol use intervention) reduced their alcohol use the most.

Methods

Study design and setting

Brief Intervention for Drug Misuse in the Emergency Department (BIDMED) was a randomized, controlled trial of adult ED patients who qualified for a drug use intervention per WHO criteria.(Humeniuk, 2010) The investigation reported in this manuscript focuses on the sub-population of alcohol-using BIDMED participants (i.e., adult ED patients who qualified for a BI for their drug use who also reported at enrollment using alcohol in the past three months). Further details about the study methodology have been published previously (Merchant et al., 2015); a summary about the study is provided as follows. BIDMED enrolled participants from July 2010-December 2012 at two urban EDs affiliated with a medical school in the same city and hospital system in New England. One ED is a Level 1 trauma center with an annual patient volume of > 100,000 adult visits, and the other is a community hospital ED with an annual patient volume of > 55,000 adult visits. In 2013–2014, among 12 year-olds and older for the state in which these EDs are located, the observed prevalence was 7.7% for alcohol abuse or dependency and 3.4% for illicit drug abuse dependency, which exceeds the national average.(Substance Abuse and Mental Health Services Administration, 2015) The hospital institutional review board approved the study.

Participant selection and eligibility

A bilingual (English- and Spanish-speaking) research assistant (RA) randomly selected patients present in the ED during study collection periods (8:00 am to midnight seven days/week), reviewed their electronic medical records for study eligibility, and confirmed eligibility through a brief interview and the study questionnaires. Potentially study eligible patients completed an audio computer self-administered interview (ACASI)-based assessment of their alcohol and drug use using the Alcohol, Smoking and Substance Involvement Screening Test, Version 3 (ASSIST V.3.) (Humeniuk R & Ali R, 2006). Patients were study eligible if they were 18–64 years-old; English- or Spanish-speaking; not critically ill or injured; not prison inmates, nor under arrest, nor undergoing home confinement; not presenting for an acute psychiatric illness; not requesting treatment for substance use/misuse; not intoxicated or did not have a physical or mental impairment that prevented them from providing consent or participating in the study; and had an ASSIST score of ≥ 4 points for any drug category or ever injected drugs (signifying a need for at least a BI, per WHO recommendations). (Humeniuk, 2010) For this investigation, participants in the parent trial who denied past 3-month alcohol use were excluded from the analysis reported in this manuscript.

Study questionnaire content and administration

Following enrollment, participants were randomly assigned 1:1 into the two study arms (BI vs. assessment/questionnaires only no BI). Participants who reported any lifetime alcohol use at enrollment through the ASSIST answered additional questions via ACASI about their alcohol use history in the past three months (any alcohol use, frequency of alcohol use, days of alcohol use, usual drinks consumed/day, and maximum drinks consumed/day) and questions about their lifetime and past three-month involvement in alcohol treatment services.(McLellan, Alterman, Cacciola, Metzger, & O'Brien, 1992) See supplement for

English-language copies of study questionnaires. Participants also were informed that the study investigators obtained a certificate of confidentiality aimed to protect their identities in regards to their responses to the study questionnaires. At three, six, nine and twelve months post-ED enrollment, participants completed the same questionnaires via the internet using the ACASI. Participants completed the baseline questionnaires in approximately 10–15 minutes. Participants received a gift card for completing the baseline and follow-up questionnaires.

Description of the BI

The primary goal of the BI was to motivate participants to reduce their drug and/or alcohol misuse and seek appropriate treatment. A brief outline of the BI content is in the supplemental material. The BI sessions were approximately 20–30 minutes in duration and were based on two theoretically-driven approaches to behavior change: motivational interviewing (Miller WR, 2002) and the health beliefs model (Rosenstock IM, 1974). During the BI the RAs took on the role of a health educator and used motivational interviewing techniques (e.g. decisional balance; discussing goals and values) (Miller & Rose, 2009) to facilitate a discussion about behavior changes. BI arm participants were contacted via telephone for a booster session by the interventionist two to four weeks post-ED enrollment and discussed progress, if any, with reaching the goals outlined during the initial BI session. The RAs met with the study investigators throughout the study to discuss clinical and procedural issues arising from the delivery of the BI. To ensure fidelity to the BI, RAs voice recorded their BI sessions, which were reviewed by the psychologist research team members and discussed with the RA. Deviations from the BI protocol were addressed and suggestions for improvement were provided at these review sessions. Although the ASSIST suggests an intensive intervention rather than a BI for those with ASSIST for alcohol or drug subscores

26 points, this investigation only provided a BI for those randomly assigned to the BI arm. However, the need to seek and attend further treatment services beyond the BI was addressed during the BI session. The RAs were blinded to participant ASSIST responses and scores, including whether any alcohol intervention and what type of drug intervention (BI or intensive intervention) were indicated per WHO recommendations.

Data analysis

Study enrollment, study arm randomization assignment and retention were summarized. Participants who denied any alcohol use during the past 3-months at enrollment were removed from further analysis for this investigation so as to focus on ED patients requiring a BI for their drug use who also drank alcohol. Those reporting any alcohol use were stratified according to their enrollment ASSIST alcohol subscore for need of an alcohol intervention, per WHO recommendations (ASSIST 10 points: no BI indicated; 11–26 points: BI for alcohol indicated; and ASSIST > 26 points: intensive intervention needed). Participants included in this investigation were compared according to their demographic characteristics by study arm (BI vs. no BI) and by ASSIST alcohol subscore strata using summary statistics with corresponding interquartile ranges (IQRs) or 95% confidence intervals (CIs), as appropriate.

Similar to other ED alcohol and drug use intervention follow-up studies, some participants did not complete every follow-up questionnaire. (Bohnert et al., 2016; D'Onofrio et al., 2012; Koivunen, Harju, Kauko, & Valimaki, 2016) Supplemental Tables 1 and 2 provide a comparison of participants who completed or did not complete each follow-up. Per recommended methods (Little & Rubin, 2002), we performed multiple imputation procedures using conditional models that used data from prior follow-ups to impute missing values for subsequent follow-ups, which is a sequential strategy that mirrors the longitudinal, prospective nature of the study (e.g., imputations of nine-month follow-up responses were conditional on six-month, three-month and baseline responses). We employed fully conditional specification methods to impute the missing data since some missing values were continuous and others were categorical. (Buuren, 2012) We assumed that data were missing at random, conditional on the covariates for study arm, baseline demographic characteristics, baseline ASSIST scores, receipt of a booster call, and baseline and prior follow-up questionnaire responses. The imputation steps were followed by imputation model diagnostics that involved comparing the means, standard deviations and histograms of the imputed data to the observed data; and then by monitoring the Monte Carlo Markov Chains while the imputation models were processing to ensure model convergence. (Gelman, Van Mechelen, Verbeke, Heitjan, & Meulders, 2005) Both diagnostic procedures indicated that the imputation models performed satisfactorily. Through these aforementioned processes we created 25 imputed datasets that were used for the subsequent analyses.

For the primary aim of examining the BI's effect at each follow-up, alcohol use and alcohol treatment services utilization during the past three months were compared between the two study arms using the imputed datasets in regards to: (1) mean proportion of participants reporting any alcohol use; (2) mean alcohol use frequency; (3) mean total days of alcohol use; (4) mean typical drinks consumed/day; (5) mean most drinks consumed/day; and (6) mean proportion of participants contacting, enrolling in and/or completing any alcohol treatment service. These summary statistics were plotted across the study period for each study arm and stratified by ASSIST alcohol subscore stratum along with corresponding 95% CIs. All 95% CIs were calculated using the usual standard error formula for multiply imputed summary statistics. (Little & Rubin, 2002) In addition, we constructed Poisson multivariable regression models to compare these outcomes between the study arms (BI vs. no BI), adjusting for baseline characteristics (age, gender, racial/ethnic group, years of education, health insurance status, employment status, being born in the United States, baseline alcohol ASSIST subscore stratum) and follow-up time (3-, 6-, 9- and 12- month follow-ups). Parameter estimates were calculated using generalized estimating equations (GEE) and an exchangeable working correlation structure to account for the longitudinal nature of the data. For each outcome, the final regression coefficients were calculated by averaging the regression coefficients over all of the imputed datasets. (Little & Rubin, 2002) Risk ratios (RRs) for the BI effect were calculated, and corresponding 95% CIs were calculated using the GEE robust standard error estimates with the aforementioned formula. (White, 1980)

For the secondary aim of determining when during follow-up and for which ASSIST alcohol subscore stratum the observed outcomes were most pronounced, we constructed Poisson

multivariable regression models including terms for the interaction between baseline alcohol ASSIST subscore stratum and follow-up time. Using the models to predict the mean outcome at baseline and each follow-up time, we calculated relative changes (decrease in alcohol use or increase in alcohol treatment services utilization) between baseline enrollment and 12-month follow-up, baseline and 3-month follow-up, and 3-month and 12-month follow-ups for all included participants and by ASSIST alcohol subscore stratum. The 3-month follow-up was used as the change point both to separate short- from long-term impact of the BI, and also because the data indicated a clear difference in trends at that point. The relative change measured the change between baseline or initial follow-up and subsequent follow-up data collection point, adjusting for the initial data collection point (e.g., relative change = $[\text{baseline alcohol use} - \text{3-month alcohol use}] / \text{baseline alcohol use}$). 95% CIs for the relative change were calculated using bootstrap percentiles with 1,000 resamples. All analyses were conducted using R version 3.3.1.

Results

Participant characteristics

The final study sample for this investigation included 421 participants in the no BI and 412 in the BI arm, respectively (Figure 1). ASSIST alcohol subscale scores were distributed similarly between the two study arms, $p < 0.46$. The demographic characteristics (Table 1) and alcohol use preferences (e.g., beer, liquor, wine, mixed drinks) (Supplemental Table 3) of those in each study arm and across ASSIST alcohol subscore strata were similar. The baseline proportions of participants who had ever received alcohol misuse treatment also were similar by study arm (4.1% [no BI] vs. 6.4% [BI]; $\Delta = -2.3\%$ [95% CI: $-5.3, 0.7\%$]).

Impact of BI on alcohol use and alcohol treatment services utilization

Alcohol use outcomes (any use, frequency of use, days of use, usual drinks consumed/day and most drinks consumed/day) decreased in both study arms from baseline, particularly in the baseline to 3-month follow-up period, and were either unchanged or decreased slowly in the 3-month to 12-month period (Figure 2). There was a small decrease in alcohol treatment services utilization over time. As shown in Figure 2 and also demonstrated in the multivariable regression models adjusting for baseline participant characteristics and follow-up period (Table 2), there were no significant differences in these outcomes by study arm (BI vs. no BI).

Relative changes in alcohol use and alcohol treatment utilization over time and by ASSIST alcohol subscore strata

Figure 3 depicts the relative changes in alcohol use and alcohol treatment utilization for the baseline to 12-month follow-up, baseline to 3-month follow-up, and 3-month to 12-month follow-up periods for all included participants and by ASSIST alcohol subscore strata. As shown, relative reduction of any alcohol in the past three months was greater in the baseline to 3-month period than 3-month to 12-month period, and also constituted the largest component of reduction in alcohol use for the 12-month study period. This reduction in any alcohol use was more pronounced for those in the lowest ASSIST alcohol subscore stratum (drank alcohol, but did not require a BI), than the other ASSIST strata, which had similar

relative reductions in this outcome. For the remaining alcohol use outcomes, relative reductions in alcohol use also were greater for the baseline to 3-month period. However, there was a step-wise effect of reductions in the other alcohol use outcomes by ASSIST alcohol subscore strata. Relative reductions in drink frequency, number of drinking days, usual drinks consumed/day, and most drinks consumed/day were the most substantial in the highest ASSIST alcohol subscore stratum (alcohol use requiring an intensive intervention) and the least substantial in the lowest ASSIST stratum (alcohol use requiring no BI). There were no clear patterns for alcohol treatment services utilization over time or by ASSIST alcohol subscore strata.

Discussion

The impact of drug use BIs in the emergency medicine setting has been discouraging, while some alcohol use BIs have been encouraging or had mixed or discouraging results. Echoing the studies with disappointing results, our findings indicate that a BI addressing alcohol and drug use among adult ED patients requiring an intervention for their drug use who also use alcohol (and may require an alcohol intervention, too) did not decrease alcohol use or increase alcohol treatment services utilization over a 12-month period more than the control condition (no BI, assessment/questionnaires only). Unfortunately, we cannot know definitively why the BI employed for this alcohol- and drug-using population was not efficacious. One obvious possible explanation is that BIs in general are not effective for these conditions or this population, and instead different approaches should be used. Another possibility is that the BI we employed was not useful due to one or more reasons—its content, focus, format, or how it was delivered and who delivered it (RAs instead of professional counselors). If true, a different BI perhaps delivered by others might have merit, although the data have been mixed in alcohol-focused BI ED research. It is also disappointing to observe that engagement in alcohol treatment services post-ED enrollment was infrequent, which likely had a significant deleterious impact on the study outcomes. Future research should investigate whether interventions, as we suspect, that incorporate greater linkage-to-care leads to more significant and sustained reductions in alcohol use.

Despite the lack of efficacy of the BI, we believe that the results of this investigation provide additional insight into interventions for alcohol and drug use among adult ED patients. First, commensurate with the findings from our prior drug use ED BI study and from multiple other ED alcohol or drug use intervention studies (Bazargan-Hejazi et al., 2005; Bogenschutz et al., 2014; D'Onofrio et al., 2012; D'Onofrio et al., 2008; Landy et al., 2016; Merchant et al., 2015; Woodruff et al., 2014), we observed reductions in self-reported alcohol use among all study participants (both BI and no BI arms). A hopeful explanation for this observation is that asking adult ED patients to self-report their alcohol use via a confidential questionnaire and giving minimal feedback that they need an intervention motivated these patients to reduce their alcohol use, regardless of whether not receiving a BI. If true, ED patients could complete self-assessments of their alcohol use confidentially and receive minimal feedback while they wait for care, which would be an automated, inexpensive, universal intervention. Of course, the self-reported reductions we observed could instead be due to social desirability biases (i.e., minimizing true alcohol use), false reporting, and regression to the mean. Objective measures of daily alcohol use over time

(likely currently impractical) and longer trends of alcohol use data are needed to confirm or refute these observations.

If self-reported alcohol use trends are accurate, it is noteworthy to observe that they are short-lived in their decline. Reductions in alcohol use were greatest in the baseline to 3-month follow-up period, with little further reductions afterwards. This short-term but no long-term additional decline also has been observed in prior ED alcohol intervention studies. (Academic ED SBIRT Research Collaborative, 2010; D'Onofrio et al., 2008; Landy et al., 2016) Possible explanations for this observation are that an intervention performed in the ED (alcohol self-assessment questionnaires with or without an intervention) has little additional impact after the short-term or the intervention is limited in how much it can reduce alcohol use (i.e., a maximum effect of the intervention). If these explanations are true, booster or ongoing interventions over time or a self-assessment questionnaire intervention combined with additional interventions might be better approaches for the long-term. Another likely, yet unproven, reason for the diminished effect over time is the infrequent use of alcohol treatment services after study enrollment. We suspect that a prime benefit of any ED substance use intervention critically depends on securing follow-up with sustained and consistent assistance. Future studies should examine this contention.

The study findings also suggest that, in general, ED patients with the highest level of alcohol use benefitted from participating in the study, in terms of reduction of drink frequency, number of drinking days, and usual and most number of drinks consumed/day. Those who drank alcohol but did not require an intervention and those requiring a BI did benefit as well, but not to the same relative degree on these outcomes, although they demonstrated greater likelihood of reported abstinence. This finding is encouraging, as ED patients requiring an intensive intervention per the ASSIST constitute a high-risk group for morbidity and mortality, as they likely include those with alcohol dependency. If the self-assessment questionnaires alone with minimal feedback were indeed valuable as a stand-alone intervention, this low-cost intervention might be promising. However, our finding is in conflict with the conclusions of a systematic review of 16 randomized, controlled trials on the effects of a BI on reducing alcohol use among adult primary care patients. (Saitz, 2010) Saitz, et al. concluded that while there was evidence to support the benefit of a BI for unhealthy alcohol use, the effects on dependent alcohol users had not been demonstrated. Future randomized, controlled trials that focus on these aspects might indicate if an appropriate BI is more efficacious for these two populations.

This study had a number of limitations. Those excluded from the study and patients at EDs in other locales might have a dissimilar spectrum of alcohol and drug use and socioeconomic and demographic characteristics, and therefore might have responded differently to the BI or the assessment/questionnaires alone (if they truly served as an intervention). Even though confidentiality and fidelity of responses likely was enhanced by the use of the ACASI approach (Caldwell & Jan, 2012; Islam et al., 2012; Newman et al., 2002; Perlis, Des Jarlais, Friedman, Arasteh, & Turner, 2004; Turner et al., 2005) and perhaps by the mention of the certificate of confidentiality, we cannot be assured that all participants answered the questions truthfully. As would be expected, other alcohol use evaluation instruments might yield different results. The study interpretation is also limited by the inability to follow-up

all participants. The disadvantaged socioeconomic existence these patients live give further evidence to the problems of their alcohol and drug misuse and challenges of conducting studies such as these. However, we believe that had we limited enrollment to those who could have been more readily tracked, external validity of the findings would have suffered. The imputations attempted to minimize the impact of loss-to-follow-up. In addition, BIDMED was designed with a sample size to detect a 25% decrease in drug use in the BI arm vs. no BI arm at each follow-up ($n=550/\text{study arm}$, 80% power, $\alpha=0.05$) and not in alcohol use. For the sample size available in this investigation, we could have detected a 7% reduction between the BI and no BI arms in any alcohol use between baseline enrollment and 3-month follow-up (20% vs. 13%; 80% power, $\alpha=0.05$). Further, BIDMED participants were not randomly assigned to the BI or no BI arms stratified their alcohol use, and we used a sub-sample of the BIDMED population, hence the study loses some of the advantages of the randomization scheme. However, we expect on average that alcohol use was balanced by study arms through randomization, as suggested by the observation that the two arms' ASSIST alcohol subscores were similar.

In conclusion, the BI employed in this investigation did not reduce alcohol use or increase alcohol treatment services utilization among adult ED patients requiring at least a BI for drug use more than questionnaires assessing alcohol use. Alcohol use, however, was reduced for all study participants, particularly in the short-term period, and especially for those whose alcohol use indicated a need for an intensive intervention. Future research should determine the value of self-assessments with minimal feedback for alcohol use as an automated, low-cost, and universal intervention to reduce alcohol use among adult ED patients.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

- Among this adult emergency department patient population for whom a drug-use intervention was recommended, concurrent alcohol use was common, and many also needed an alcohol use intervention.
- Self-reported alcohol use decreased among all participants, whether or not they received a brief intervention.
- Alcohol use reductions were greatest during the first three months post-enrollment, then decreased slowly or little afterwards within one year of follow-up.
- The brief intervention employed in this investigation did not reduce alcohol use or increase alcohol treatment services utilization more than the assessment/questionnaires-only condition.
- Reported alcohol use reductions were greater, even after adjusting for baseline use, among participants whose alcohol use indicated a need for more intensive interventions.

Fig. 1. Participant enrollment. ASSIST=Alcohol, Smoking and Substance Involvement Screening Test alcohol subscore.

Fig. 2.

Mean measured alcohol outcomes for each study arm at each follow-up time, overall and by baseline ASSIST score. ASSIST=Alcohol, Smoking, and Substance Involvement Screening Test alcohol subscore; BI=brief intervention.

Fig. 3.

Relative change in measured alcohol outcomes between baseline and 12-MFU, between baseline and 3-MFU, and between 3-MFU and 12-MFU, overall and by baseline ASSIST score. ASSIST=Alcohol, Smoking and Substance Involvement Screening Test alcohol subscore; MFU=month follow-up. ^a Relative change for an individual with the mean value of each demographic variable (aged 32 years; male, white, non-Hispanic; not a college graduate; no health insurance; not employed full-time; born in the United States; baseline ASSIST score = 11).

Table 1

Baseline demographic characteristics by study arm and baseline ASSIST score.

Patient characteristics	All <i>n</i> = 833		Brief intervention <i>n</i> = 421		No brief intervention <i>n</i> = 412		ASSIST 10 <i>n</i> = 463		11 ASSIST <i>n</i> = 230		26 ASSIST <i>n</i> = 140		27 ASSIST <i>n</i> = 140	
	% (<i>n</i>)	95% CI	% (<i>n</i>)	95% CI	% (<i>n</i>)	95% CI	% (<i>n</i>)	95% CI	% (<i>n</i>)	95% CI	% (<i>n</i>)	95% CI	% (<i>n</i>)	95% CI
Age (years)														
Median (IQR)	29.0	(23.0–41.0)	30.0	(23.0–41.0)	29.0	(23.0–40.3)	28.0	(22.0–36.5)	29.0	(24.0–40.8)	39.0	(30.8–47.0)		
Gender														
Female	45.7 (381)	44.0–47.4	48.0 (202)	45.6–50.4	43.4 (179)	41.0–45.8	51.8 (240)	49.5–54.1	38.7 (89)	35.6–41.8	37.1 (52)	33.2–41.0		
Male	54.3 (452)	52.6–56.0	52.0 (219)	49.6–54.4	56.6 (233)	54.2–59.0	48.2 (223)	45.9–50.5	61.3 (141)	58.2–64.4	62.9 (88)	59.0–66.8		
Race/Ethnicity														
Black, Hispanic	5.5 (46)	5.1–5.9	5.7 (24)	5.2–6.2	5.3 (22)	4.8–5.8	6.3 (29)	5.8–6.8	4.8 (11)	4.2–5.4	4.3 (6)	3.6–5.0		
Black, non-Hispanic	26.7 (222)	25.4–28.0	28.3 (119)	26.4–30.4	25.0 (103)	23.2–26.8	21.8 (101)	20.2–23.4	30.4 (70)	27.7–33.1	36.4 (51)	32.6–40.2		
White, Hispanic	9.7 (81)	9.1–10.3	8.3 (35)	7.6–9.0	11.2 (46)	10.2–12.2	9.5 (44)	8.7–10.3	12.2 (28)	10.8–13.6	6.4 (9)	5.4–7.4		
White, non-Hispanic	55.3 (461)	53.6–57.0	54.9 (231)	52.5–57.3	55.8 (230)	53.4–58.2	59.8 (277)	57.6–62.0	49.1 (113)	45.9–52.3	50.7 (71)	46.6–54.8		
Other	2.8 (23)	2.6–3.0	2.9 (12)	2.6–3.2	2.7 (11)	2.4–3.0	2.6 (12)	2.4–2.8	3.5 (8)	3.1–3.9	2.1 (3)	1.8–2.4		
Years of education														
4-year college graduate or beyond	7.7 (64)	7.2–8.2	6.4 (27)	5.8–7.0	9.0 (37)	8.2–9.8	9.3 (43)	8.5–10.1	5.2 (12)	4.6–5.8	6.4 (9)	5.4–7.4		
1–3 years of college	25 (208)	23.7–26.3	23.3 (98)	21.6–25.0	26.7 (110)	24.8–28.6	28.1 (130)	26.3–29.9	22.6 (52)	20.3–24.9	18.6 (26)	16.1–21.1		
12 years of secondary education	30.9 (257)	29.5–32.3	30.6 (129)	28.6–32.6	31.1 (128)	29.0–33.2	29.6 (137)	27.7–31.5	34.3 (79)	31.4–37.2	29.3 (41)	25.9–32.7		
Less than 12 years of secondary education	36.5 (304)	34.9–38.1	39.7 (167)	37.4–42.0	33.3 (137)	31.2–35.4	33.0 (153)	31.0–35.0	37.8 (87)	34.8–40.8	45.7 (64)	41.6–49.8		
Health insurance status														
Governmental	35.9 (299)	34.3–37.5	35.9 (151)	33.7–38.1	35.9 (148)	33.7–38.1	35.6 (165)	33.5–37.7	34.3 (79)	31.4–37.2	39.3 (55)	35.3–43.3		
Private	23.6 (197)	22.4–24.8	23.5 (99)	21.8–25.2	23.8 (98)	22.0–25.6	26.8 (124)	25.0–28.6	22.6 (52)	20.3–24.9	15.0 (21)	12.9–17.1		
None	40.5 (337)	38.9–42.1	40.6 (171)	38.3–42.9	40.3 (166)	38.0–42.6	37.6 (174)	35.5–39.7	43.0 (99)	39.8–46.2	45.7 (64)	41.6–49.8		
Partner status														
Married	11 (92)	10.3–11.7	11.6 (49)	10.6–12.6	10.4 (43)	9.5–11.3	13.2 (61)	12.2–14.2	9.1 (21)	8.0–10.2	7.1 (10)	6.0–8.2		
Divorced/Widowed/Separated	15.1 (126)	14.2–16.0	16.2 (68)	14.9–17.5	14.1 (58)	12.9–15.3	11.2 (52)	10.3–12.1	15.7 (36)	14.0–17.4	27.1 (38)	23.8–30.4		
Unmarried couple	19.1 (159)	18.1–20.1	18.1 (76)	16.7–19.5	20.1 (83)	18.5–21.7	19.2 (89)	17.8–20.6	20.0 (46)	17.9–22.1	17.1 (24)	14.8–19.4		
Never married	54.7 (456)	53.0–56.4	54.2 (228)	51.8–56.6	55.3 (228)	52.9–57.7	56.4 (261)	54.2–58.6	55.2 (127)	52.0–58.4	48.6 (68)	44.5–52.7		
Homeless status														

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Patient characteristics	All <i>n</i> = 833		Brief intervention <i>n</i> = 421		No brief intervention <i>n</i> = 412		ASSIST 10 <i>n</i> = 463		11 ASSIST 26 <i>n</i> = 230		ASSIST 27 <i>n</i> = 140	
	% (<i>n</i>)	95% CI	% (<i>n</i>)	95% CI	% (<i>n</i>)	95% CI	% (<i>n</i>)	95% CI	% (<i>n</i>)	95% CI	% (<i>n</i>)	95% CI
Currently homeless	11.9 (99)	11.2–12.6	12.8 (54)	11.7–13.9	10.9 (45)	10.0–11.8	6.9 (32)	6.3–7.5	13.9 (32)	12.4–15.4	25.0 (35)	21.9–28.1
Homeless in past 12 months	8.9 (74)	8.3–9.5	9.0 (38)	8.2–9.8	8.7 (36)	7.9–9.5	6.7 (31)	6.1–7.3	7.8 (18)	6.9–8.7	17.9 (25)	15.5–20.3
Not homeless in past 12 months	79.2 (660)	78.1–80.3	78.1 (329)	76.5–79.7	80.3 (331)	78.8–81.8	86.4 (400)	85.3–87.5	78.3 (180)	76.1–80.5	57.1 (80)	53.0–61.2
Employment status												
Employed full-time	25.7 (214)	24.4–27.0	22.6 (95)	20.9–24.3	28.9 (119)	26.9–30.9	30.0 (139)	28.1–31.9	24.3 (56)	21.9–26.7	13.6 (19)	11.7–15.5
Not employed full-time	74.3 (619)	73.0–75.6	77.4 (326)	75.7–79.1	71.1 (293)	69.1–73.1	70.0 (324)	68.1–71.9	75.7 (174)	73.3–78.1	86.4 (121)	84.5–88.3
Usual source of medical care												
Emergency department	42.3 (352)	40.6–44.0	42.0 (177)	39.7–44.3	42.5 (175)	40.1–44.9	38.0 (176)	35.9–40.1	47 (108)	43.8–50.2	48.6 (68)	44.5–52.7
Hospital or community health clinics	28.6 (238)	27.2–30.0	28.5 (120)	26.6–30.4	28.6 (118)	26.6–30.6	27.4 (127)	25.6–29.2	28.3 (65)	25.7–30.9	32.9 (46)	29.2–36.6
Private clinic/practice	26.2 (218)	24.9–27.5	26.8 (113)	24.9–28.7	25.5 (105)	23.7–27.3	31.3 (145)	29.3–33.3	22.2 (51)	20.0–24.4	15.7 (22)	13.5–17.9
Urgent care center	2.8 (23)	2.6–3.0	2.6 (11)	2.4–2.8	2.9 (12)	2.6–3.2	3.0 (14)	2.7–3.3	2.2 (5)	1.9–2.5	2.9 (4)	2.4–3.4
Don't know/Refuse to answer	0.2 (2)	0.2–0.2	0.0 (0)	0.0–0.0	0.5 (2)	0.5–0.5	0.2 (1)	0.2–0.2	0.4 (1)	0.3–0.5	0.0 (0)	0.0–0.0
Born in United States												
Yes	92.8 (773)	92.3–93.3	92.9 (391)	92.3–93.5	92.7 (382)	92.0–93.4	93.1 (431)	92.5–93.7	91.3 (210)	90.3–92.3	94.3 (132)	93.4–95.2
No	7.2 (60)	6.7–7.7	7.1 (30)	6.5–7.7	7.3 (30)	6.6–8.0	6.9 (32)	6.3–7.5	8.7 (20)	7.7–9.7	5.7 (8)	4.8–6.6

ASSIST=Alcohol, Smoking and Substance Involvement Screening Test alcohol subscore; CI=confidence interval

Table 2

Relationship between measured alcohol outcomes and study arm.

Measured alcohol outcome	RR	95% CI
Any alcohol use in the past three months ^a		
Brief intervention		Ref
No brief intervention	1.02	0.95–1.09
Drink frequency in the past three months		
Brief intervention		Ref
No brief intervention	1.04	0.98–1.10
Number of days of drinking in the past three months		
Brief intervention		Ref
No brief intervention	1.11	0.97–1.28
Usual number of drinks in one day in the past three months		
Brief intervention		Ref
No brief intervention	0.93	0.78–1.11
Most number of drinks in one day in the past three months		
Brief intervention		Ref
No brief intervention	0.98	0.83–1.15
Treatment utility in the past three months		
Brief intervention		Ref
No brief intervention	0.92	0.63–1.34

ASSIST=Alcohol, Smoking and Substance Involvement Screening Test alcohol subscore; CI=confidence interval; RR=multivariate-adjusted risk ratio

All models were additionally adjusted for age, gender, racial/ethnic group, years of education, health insurance status, employment status, being born in the United States, baseline ASSIST score stratum, and follow-up time

^aBaseline measures were excluded due to complete separation of the outcome