The Impact of Screening, Brief Intervention, and Referral for Treatment on Emergency Department Patients' Alcohol Use

Academic ED SBIRT Research Collaborative*

Study objective: We determine the impact of a screening, brief intervention, and referral for treatment (SBIRT) program in reducing alcohol consumption among emergency department (ED) patients.

Methods: Patients drinking above National Institute of Alcohol Abuse and Alcoholism low-risk guidelines were recruited from 14 sites nationwide from April to August 2004. A quasiexperimental comparison group design was used in which control and intervention patients were recruited sequentially at each site. Control patients received a written handout. The intervention group received the handout and a brief intervention, the Brief Negotiated Interview, to reduce unhealthy alcohol use. Follow-up surveys were conducted at 3 months by telephone using an interactive voice response system.

Results: Of 7,751 patients screened, 2,051 (26%) exceeded the low-risk limits set by National Institute of Alcohol Abuse and Alcoholism; 1,132 (55%) of eligible patients consented and were enrolled (581 control, 551 intervention). Six hundred ninety-nine (62%) completed a 3-month follow-up survey, using the interactive voice response system. At follow-up, patients receiving a Brief Negotiated Interview reported consuming 3.25 fewer drinks per week than controls (coefficient [B] −3.25; 95% confidence interval [CI] −5.76 to −0.75), and the maximum number of drinks per occasion among those receiving Brief Negotiated Interview was almost three quarters of a drink less than controls (B −0.72; 95% CI −1.42 to −0.02). At-risk drinkers (CAGE <2) appeared to benefit more from a Brief Negotiated Interview than dependent drinkers (CAGE >2). At 3-month follow-up, 37.2% of patients with CAGE less than 2 in the intervention group no longer exceeded National Institute of Alcohol Abuse and Alcoholism low-risk limits compared with 18.6% in the control group (Δ 18.6%; 95% CI 11.5% to 25.6%).

Conclusion: SBIRT appears effective in the ED setting for reducing unhealthy drinking at 3 months. [Ann Emerg Med. 2007;50:699-710.]

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INTRODUCTION

Background

Unhealthy alcohol use, ranging from at-risk drinking to dependence, is a leading cause of morbidity, mortality, and cost in the United States.[1-8] There is substantial evidence from primary care settings that brief interventions with at-risk drinkers reduce alcohol abuse, increase treatment contact, and are cost effective.[9-12] Despite the high prevalence, morbidity, and mortality of alcohol-related emergency department (ED) visits,[13-19] brief intervention techniques have not been tested widely in EDs. Health care providers confront the consequences of alcohol abuse daily but often lack the skills to engage patients in health-promoting behavior change.[20,21]

*All members are listed in Appendix 1.

Importance

Recent studies offer encouraging evidence concerning the efficacy of brief interventions in the ED setting when performed by a variety of non-ED providers.[22-26] Hospital EDs offer a teachable moment to address the consequences of unhealthy alcohol use across the entire spectrum of severity and effect a behavior change that could improve patient outcomes, especially among those whose visit was alcohol related.[22,25,26] However, the effectiveness of brief interventions delivered by ED providers themselves has not yet been clearly demonstrated.

Goals of This Investigation

We sought to determine the effectiveness of ED provider–initiated Screening, Brief Intervention, and Referral to alcohol Treatment (SBIRT) to reduce alcohol consumption among patients reporting unhealthy levels of alcohol use.

Editor's Capsule Summary

What is already known on this topic

Brief interventions to modify problematic alcohol consumption have been proven effective in primary care but have not been tested in the emergency department (ED).

What question this study addressed

This 14-ED, 1,132-patient, time-series trial examined whether a brief intervention resulted in decreased self-reported unhealthy alcohol use at 3 months.

What this study adds to our knowledge

The brief intervention decreased reported drinking by more than 3 drinks per week at 3 months. Thirty-seven percent of those who received the intervention reported they no longer exceeded low-risk drinking limits compared with 19% of the control group.

How this might change clinical practice

This study suggests that a brief intervention can be efficacious, particularly in patients who are not alcohol dependent. Further studies about the cost-effectiveness and impact of this practice on actual documented alcohol consumption are warranted.

MATERIALS AND METHODS

Study Design

A quasiexperimental comparison group design was used to evaluate the effectiveness of SBIRT in the ED setting.[27] Participants assigned to the control group received screening for at-risk drinking and a written list of referral resources. On completion of a standardized 2-hour educational curriculum based on work at Boston Medical Center and Yale University,[23,28,29] trained ED providers delivered the brief intervention, namely, the Brief Negotiated Interview, to participants during the subsequent intervention period. The sequential recruitment of control and intervention patients as opposed to randomized assignment was motivated by the concern that, on learning Brief Negotiated Interview techniques, ED providers would find it difficult not to use these skills on all patients, leading to contamination of the control group.

Setting

Participants included adults recruited at the 14 academic EDs across the United States. Registered ED patients were eligible for enrollment if they were older than 18 years, screened positive for drinking over the National Institute of Alcohol Abuse and Alcoholism low-risk limits, spoke English or Spanish, were not currently in custody or substance abuse treatment, and were medically stable and fully oriented. Homeless status was not considered a factor in enrollment. As long as potential participants indicated their intent to remain in the area throughout the study period, they were eligible for enrollment.

ED patients at each site were recruited in 2 sequential enrollment periods. Recruitment of control patients began in April 2004 and continued until 40 patients were enrolled at each site (median recruitment period for control patients was 12 days). Recruitment of intervention patients began as early as late April 2004 and continued until 40 patients were enrolled at each site (median recruitment period for intervention patients was 25 days). Research assistants performed universal screening on all adult patients determined by a nurse or physician to be medically stable, during day and evening shifts, 7 days a week, to determine eligibility for the study. All patients, whether treated and released or admitted, were included. Patients who verbally agreed to participate were screened with the National Alcohol Screening Day screening form adapted for emergency medicine.[30] This screening tool included the National Institute of Alcohol Abuse and Alcoholism's 3 quantity and frequency questions, as well as the 4 CAGE questions (for additional data, see the *Annals* Web site, available online at http://www.annemergmed.com).[31] Patients exceeding the low-risk guidelines according to the National Institute of Alcohol Abuse and Alcoholism (for additional data see the *Annals* Web site; available online at http://www.annemergmed.com) were invited to participate. On providing informed consent, patients in each group completed an intake form to identify participants' baseline characteristics. In the first (control group) enrollment period, participants received only a written list of local referral resources.

Between the enrollment periods, ED staff at each site participated in a 2-hour structured training session designed to teach the principles and techniques of SBIRT. The SBIRT curriculum offered at the 14 sites by 3 experts in ED SBIRT consisted of (1) didactic information using a slide presentation on the science, effectiveness, and practice of SBIRT; (2) a series of 5 video simulated cases demonstrating the skills of ED providers performing the Brief Negotiation Interview algorithm; and (3) a skills-based practice session using scripted case scenarios with defined critical action. Participants were provided with pocket-sized plastic cards with National Institute of Alcohol Abuse and Alcoholism screening guidelines, a graphic display of typical drinks and standard equivalents, and the intervention algorithm (Figure 1).[29] Site education coordinators used the National Institute of Alcohol Abuse and Alcoholism–sponsored ED SBIRT Web site to train those who could not attend the workshops (http://www.ed.bmc.org/sbirt).[28]

During the second (intervention group) enrollment period, an SBIRT-trained ED staff member (eg, physician, nurse/nurse practitioner, social worker, emergency medical technician [EMT]) delivered a Brief Negotiated Interview for participants meeting the National Institute of Alcohol Abuse and Alcoholism criteria. Patients who screened over the low-risk limits were referred by the research assistants to trained providers, who conducted the Brief Negotiated Interview according to their availability. All participants received $10 at enrollment and $20 for each telephone follow-up assessment.

The project was approved by the institutional review boards at all participating sites. In addition, a certificate of

BNI STEPS	DIALOGUE/PROCEDURES
1. Raise subject	➢ Hello, I am _____. Would you mind taking a few minutes to talk with me about your alcohol use? **<<PAUSE and LISTEN>>**
2. Provide feedback	
• **Review screen**	➢ From what I understand you are drinking [insert screening data]… We know that drinking above certain levels can cause problems, such as [insert facts]…I am concerned about your drinking.
• **Make connection**	➢ What connection (if any) do you see between your drinking and this ED visit? **If pt sees connection:** reiterate what pt has said **If pt does not see connection:** make one using facts
• **Show NIAAA guidelines & norms**	➢ These are what we consider the upper limits of low risk drinking for your age and sex. By low risk we mean that you would be less likely to experience illness or injury if you stayed within these guidelines.
3. Enhance motivation	
• **Readiness to change**	➢ **[Show readiness ruler]** On a scale from 1-10, how ready are you to change any aspect of your drinking?
• **Develop discrepancy**	➢ **If patient says:** **≥2 ask** Why did you choose that number and not a lower one?
• **Explore Pros and Cons**	**< 2 or resistance ask pros and cons** Help me to understand what you enjoy about drinking? **<<PAUSE AND LISTEN>>** Now tell me what you enjoy less about drinking. **<<PAUSE AND LISTEN>>**
• **Use Reflective Listening**	➢ On the one hand you said, **<<RESTATE PROS>>** ➢ On the other hand you said, **<<RESTATE CONS>>** So tell me, where does this leave you?
4. Negotiate & advise	
• **Negotiate goal**	➢ What's the next step?
• **Give advice**	➢ What do you think you can do to stay within the safe drinking guidelines? If you can stay within these limits you will be less likely to experience [further] illness or injury related to alcohol use.
• **Summarize**	➢ This is what I've heard you say…Here is a drinking agreement I would like you to fill out, reinforcing your new drinking goals. This is really an agreement between you and yourself. Provide drinking agreement [pt keeps 1 copy]
• **Provide handouts and suggest PC f/u**	➢ **Suggest Primary Care f/u to discuss drinking level/pattern**
• **Thank patient**	➢ **Thank patient for his/her time**

Figure 1. Intervention algorithm. *BNI*, Brief Negotiation Interview; *PC*, primary care. Adapted from.[29]

confidentiality covering all sites was obtained from the National Institute of Alcohol Abuse and Alcoholism.

The Brief Negotiated Interview, based on research on the efficacy of motivational interviewing,[32-37] was adapted for the ED setting.[23,28,29] Specifics of this very structured intervention are reported elsewhere.[29] The mean time for completion in that study was 7.8 minutes (SD 3.2 minutes), with a range of 4 to 24 minutes.

The Brief Negotiated Interview consists of a 4-step process: Raising the subject is an opportunity to engage the patient and ask permission to discuss alcohol use. In providing feedback, current drinking patterns are reviewed. The patient is asked whether he or she sees any connection between the ED visit and drinking. The provider may make a connection if the patient does not see one. National Institute of Alcohol Abuse and Alcoholism low-risk drinking guidelines are presented. The provider uses the concept of reflective listening.

At this point, using a readiness ruler, the provider assesses readiness to change by asking the patient, "On a scale from 1 to 10, how ready are you to change any aspect of your drinking [1 being not ready and 10 being very ready for change]?" If the patient answers greater than 2, then the question becomes, "Why did you not pick a lower number?" This allows the patient to identify reasons for change that can be further reflected on and discussed.

For patients who choose a low number (particularly <3) or are resistant, it may be helpful to explore pros and cons of drinking, and further discussion to aid decisional balance may include what may need to happen for them to make a change or asking whether they have ever done anything they wish they had not while drinking.

Negotiation and advising asks what the next steps are. A menu of options for behavioral change may be discussed. A written prescription for change or a drinking agreement is negotiated. In addition, assistance in obtaining appointments for primary care or placement in a formal treatment program is provided, along with a written handout of the low-risk guidelines. The patients are then thanked for their time.

Three months after enrollment, participants were contacted by telephone to complete a follow-up survey with an automated interactive voice response system. Respondents answered survey questions by pressing the keys on the telephone pad. These responses were entered automatically into a database. In advance of the interactive voice response calls, patients were contacted by mail, with written instructions explaining the interactive voice response procedure, and automated reminder calls were placed to the patients' primary phone number for 2 weeks. Patients who did not complete the follow-up at the end of 2 weeks of interactive voice response attempts were telephoned by research staff using all available contact information. Participants successfully contacted by interviewers were transferred to the interactive voice response system to complete the automated survey. After 4 weeks, local site coordinators attempted to locate participants who had not completed the follow-up. Participants successfully contacted by local site coordinators were transferred to the interactive voice response system to complete the automated survey. All participants completing the follow-up survey were mailed a $20 honorarium.

Methods of Measurement

The National Alcohol Screening Day screening form is a 1-page questionnaire that includes 3 standard questions about aspects of alcohol use. These include: the frequency of alcohol use (eg, the number of days per week the respondent drinks alcohol), the quantity of alcohol use on a typical day during the past 12 months, and the maximum number of drinks on any given day during the past month. Patients were considered at risk if, by self-report, they exceeded the National Institute of Alcohol Abuse and Alcoholism guidelines for low-risk drinking (for additional data, see the *Annals* Web site, available online at http://www.annemergmed.com).[30] For comparability with other studies of drinking interventions, the frequency of alcohol use was multiplied by the quantity of alcohol use on a typical day to yield an estimate of the average number of drinks per week. In addition, the National Alcohol Screening Day form includes the CAGE instrument; 2 positive responses to this 4-item measure indicate possible alcohol dependency.[31,38]

Once enrolled, participants completed a self-report intake form, which required 5 to 10 minutes to complete. The intake form captured basic demographic and socioeconomic information (eg, marital status, education, language spoken at home, work status, living situation, and health insurance status).

The 3-month follow-up survey contained the same baseline questions about drinking behavior during the past 30 days (eg, quantity, frequency, and maximum use). In addition, participants answered questions about participation in and completion of various alcohol treatment options since enrollment: detoxification program, residential treatment, inpatient treatment, outpatient counseling, and Alcoholics Anonymous.

Primary Data Analysis

To account for the clustered sampling design in which patients were nested within sites, SUDAAN 9.0.1 (RTI International, Research Triangle Park, NC) was used to calculate χ^2 or t test statistics for bivariate analyses and perform regression analyses of intervention effects.[39] SUDAAN was specifically developed to address the complicated variance estimation required in the analysis of data obtained using complex sampling designs, including cluster-correlated data. In our analysis, the effect of exposure to the Brief Negotiated Interview on follow-up drinking behavior (D_2) was estimated with the following regression model:

$$D_2 = B_0 + B_1D_1 + B_{2-7}\text{Controls}_{2-7} + B_8G_1 \qquad (1)$$

where D_2 is drinking at follow-up and D_1 is baseline drinking; G_1 is a dummy variable for intervention status; $Controls_{2\text{-}7}$ refers to a series of demographic characteristics, including highest level of education completed and dummy variables for sex (female versus male), race/ethnicity (black, Hispanic, other race) with white race as the omitted referent category, homeless status (homeless versus nonhomeless), and health insurance status (insured by public or private plan versus noninsured). Demographic control variables that in preliminary analyses were significantly associated with the outcome variables, intervention group membership, or attrition from the study at 3 months were included in the final regression model.

Participants who were missing any of the baseline or follow-up drinking variables—typical number per week (n=8) or maximum number per occasion (n=7)—were excluded from analyses. To include all participants with valid baseline and follow-up drinking data in the analyses, missing values on control variables were imputed. Missing values for race (n=14) and work status (n=12) were imputed with the mode of the participant's site. Education (n=29) and health status (n=14) were imputed with the mean of the participant's site. Twenty patients assigned to the intervention group who did not actually receive the Brief Negotiated Interview remained in the intervention group to estimate intention-to-treat effects.

RESULTS

A total of 402 ED staff members were trained in the Brief Negotiated Interview: 60% were physicians (attending physicians and residents), 21% nurses, 7% physician extenders (physician assistants and advanced practice nurses), and 12% social workers and EMTs. Forty-nine percent of all Brief Negotiated Interviews provided to patients were delivered by physicians, 19% by nurses,

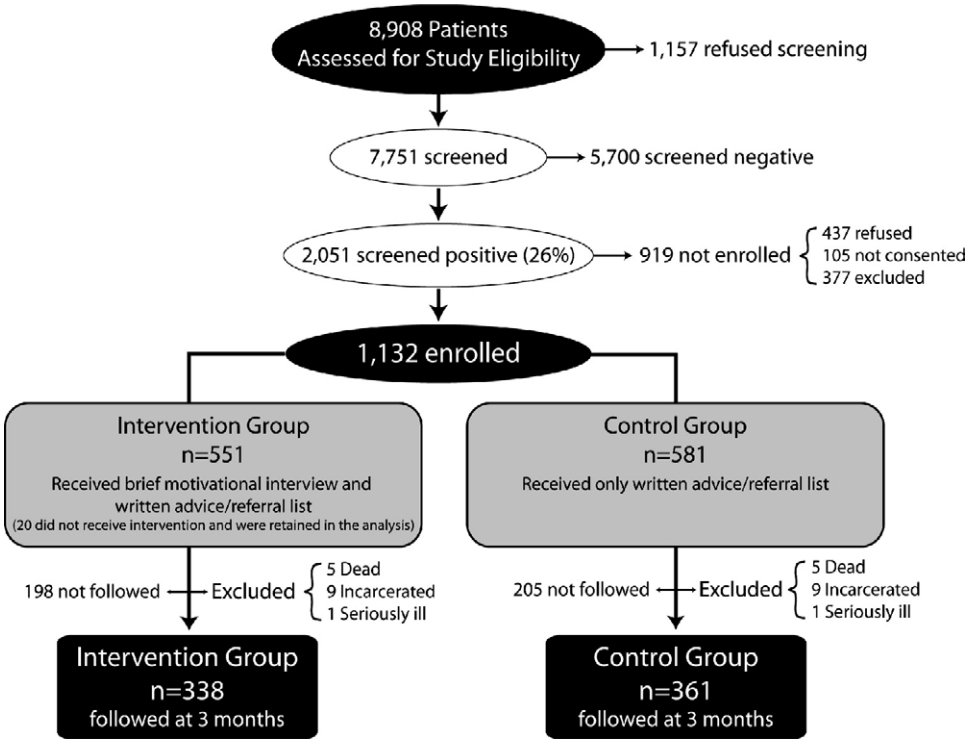

Figure 2. Profile of an ED SBIRT trial through 3 months of follow-up.

19% by physician extenders, and 10% by social workers and EMTs.

Screening and enrollment results are presented in Figure 2. A total of 8,908 patients were approached at the sites; 7,751 agreed to screening. Of those completing the screening form, 2,051 (26%) screened positive for drinking above the National Institute of Alcohol Abuse and Alcoholism low-risk guidelines. Of those who screened positive for at-risk drinking, 1,132 participants (55%) were enrolled in the study (551 intervention, 581 control). Among participants, 32% were women, 37% were black, 20% were Hispanic, and 39% were white.

To assess differences between patients' refusing to participate and those enrolled in the study, a logistic regression model was estimated, predicting participation status. Eligible patients were less likely to participate as age increased and baseline maximum drinks per occasion decreased. The magnitude of these differences was small, with a mean age among refusers of 38.5 compared to 35.8 among participants and mean levels of maximum drinks of 8.0 among refusers and 8.6 among participants. Typical weekly drinking levels did not predict participation status in the study.

The demographic characteristics and baseline alcohol use of patients in the sample are presented in Table 1A and B, respectively. Bivariate analyses were conducted to assess the comparability of the intervention group and control group in terms of sex, race/ethnicity, age, education, marital status, employment status, living situation, health insurance enrollment, and drinking characteristics. Except for homelessness and race, there were no important differences in the baseline characteristics of the 2 groups. Baseline measures of the typical number of drinks per week and maximum number of drinks per occasion were similar between study limbs. To assess differences between the intervention and control groups at baseline with a multivariate approach, models were estimated that predicted baseline drinking levels by

Table 1. A, Baseline demographic characteristics.

Demographics	Control, % (n=581)	Intervention, % (n=551)	Total, % (n=1,132)
Sex, male	68	69	68
Race			
Black	35	40	37
White	40	37	39
Hispanic	22	18	20
Mean age, y	36	35	36
Health insurance, yes	55	49	52
Education			
Not high school graduate	30	23	27
High school graduate	31	36	33
Some college/technical	29	30	29
College graduate	10	11	11
Married	15	19	17
Employment status			
Full time (35+ h)	34	36	35
Part time (<35 h)	15	17	16
Not working	52	47	49
Homeless	14	9	11
Past alcoholic treatment	23	21	22

Table 1. B, Baseline drinking characteristics (N=1,132).

Characteristic	Mean	CI	Minimum	Maximum
Days drinking				
Total	3.4	(3.2–3.5)	0	7
Control	3.4	(3.2–3.6)	0	7
Intervention	3.3	(3.1–3.5)	0	7
Typical weekly drinks				
Total	23.5	(22.0–24.9)	0	84
Control	24.1	(22.1–26.1)	0	84
Intervention	22.8	(20.8–24.9)	0	84
Maximum drinks				
Total	8.6	(8.4–8.8)	0	12
Control	8.5	(8.2–8.8)	0	12
Intervention	8.7	(8.4–8.9)	0	12
CAGE score				
Total	1.8	(1.8–1.9)	0	4
Control	1.9	(1.8–2.0)	0	4
Intervention	1.8	(1.7–1.9)	0	4

intervention status, controlling for all demographic variables ultimately included in the final predictive models (Table 2). Consistent with the bivariate analysis reported above, baseline levels of typical drinks per week and maximum drinks per occasion did not vary by experimental group.

Sixty-two percent of patients completed the 3-month survey (n=699) (Figure 2). Men, those without health insurance, and those with less education were less likely to complete the follow-up. Experimental condition (intervention versus control) was not associated with attrition. Preliminary analyses were conducted to assess whether any of the characteristics in Table 1A and B predicted differential attrition between the control and intervention groups. Separate logistic regressions predicting attrition were performed for each demographic characteristic in Table 1A, the intervention group indicator variable, and their interaction. Only 1 interaction was significant: homeless persons in the intervention group were more likely to complete the follow-up.

Coefficients (B) and confidence intervals (CI) from regression models predicting self-reported drinking at 3 months are presented in Table 2. Compared to the control group, those receiving the Brief Negotiated Interview reported significantly lower levels of both typical drinks per week and maximum drinks per occasion at the 3-month follow-up, controlling for baseline characteristics. Those receiving the Brief Negotiated Interview reported consuming roughly 3.25 fewer drinks per week than controls (B −3.25; 95% CI −5.76 to −0.75). In addition, Brief Negotiated Interview participants reported a level of maximum drinks per occasion of almost three quarters of a drink less than controls (B −0.72; 95% CI −1.42 to −0.02). To demonstrate the clinical significance of these findings, conditional marginal means derived from the models in Table 2 were calculated. Conditional marginal mean values for the baseline drinking measures were adjusted for the control variables included in Table 2 and therefore differ from the simple means presented in Table 1B. These data reveal that typical weekly drinks decreased from 22.9 to 17.4 on average in the control group and from 22.5 to 14.1 in the Brief Negotiated Interview group. Maximum drinks decreased from 8.4 to 7.2 on average in the control group and from 8.6 to 6.5 in the Brief Negotiated Interview group. (For additional data, see the *Annals* Web site, available online at http://www.annemergmed.com.)

At follow-up, 27.8% of the intervention group compared to 18.4% of the control group no longer exceeded National Institute of Alcohol Abuse and Alcoholism low-risk limits (Δ 9.3%; 95% CI 3.3% to 15.3%). Among those no longer exceeding the National Institute of Alcohol Abuse and Alcoholism criteria, the average decrease in typical weekly drinks was 13.7, and the average decrease in maximum drinks per occasion was 5.8. These reductions did not differ between Brief Negotiated Interview and control groups. Finally, rates of alcohol treatment in the 3 months after enrollment are presented in Table 3. Results indicate that exposure to the Brief Negotiated Interview was unrelated to either participation in or completion of treatment.

One critical issue is whether the Brief Negotiated Interview was equally effective among those whose drinking would be considered at risk by National Institute of Alcohol Abuse and Alcoholism criteria, namely, drinking above low-risk limits versus alcohol-dependent patients. To test this hypothesis, participants were divided into 2 groups according to their baseline CAGE scores. A CAGE score of greater than 2 was considered evidence of possible dependency (N=377; 54% of sample), whereas at-risk participants with a CAGE score of 0 or 1 were considered unlikely to be dependent (N=322; 46%).[31,38] To have efficacy with dependent drinkers, the intervention would have had to be associated with decreases in alcohol consumption of far greater magnitude relative to at-risk drinkers, given the substantial differences in base rates for these groups: for instance, baseline mean drinks per week were about 11 for CAGE less than 2 but exceeded 34 for CAGE greater than 2. To determine the effect of baseline CAGE scores on the effectiveness of the intervention, a product term for the CAGE×Brief Negotiated Interview interaction was added to equation 1. The product term did not achieve statistical significance, but in this case the *absence* of a statistically significant interaction effect is both substantively and clinically meaningful, given the much larger Brief Negotiated Interview effects that would be required to affect the risk status of those with CAGE greater than or equal to 2. To further examine these patterns of effects, we present in Table 4 results from estimation of equation 1 separately for among CAGE less than 2 and CAGE greater than 2. These results indicate that intervention patients with a baseline CAGE less than 2 reported consuming 1.23 fewer drinks per maximum drinking episode than did control participants with CAGE less than 2 and 2.8 fewer drinks per week than control participants with CAGE less than 2. Both effects achieved statistical significance at the .05 level. In contrast, neither the maximum number of drinks per occasion nor typical number of drinks per week differed significantly among intervention and control patients with a CAGE score of 2 or more. Further evidence of the differences in the efficacy of the Brief Negotiated Interview among these groups is seen in the numbers of patients drinking above National Institute of Alcohol Abuse and Alcoholism low-risk levels at 3 months: 37.2% of CAGE less than 2 intervention patients no longer

Table 2. Effects of the Brief Negotiated Interview on drinking behavior at 3 months, total sample (N=699).

	Typical Weekly Drinks		Maximum Drinks	
Predictors	**B**	**CI**	**B**	**CI**
Intercept	15.71	(10.54–20.89)	5.16	(4.11–6.21)
Brief Negotiated Interview	−3.25	(−5.76 to −0.75)	−0.72	(−1.42 to −0.02)
Baseline drinks	0.27	(0.21–0.34)	0.37	(0.29–0.45)
Female	−1.75	(−5.76 to 1.31)	−0.19	(−0.92 to 0.54)
Hispanic	−8.01	(−11.71 to−4.30)	−1.97	(−2.54 to −1.39)
Black	−0.32	(−4.41 to 3.78)	−1.01	(−1.64 to −0.37)
Other race	0.50	(−6.18 to 7.19)	−0.11	(−1.21 to 1.00)
Education	−0.04	(−1.00 to 0.93)	−0.01	(−0.28 to 0.27)
Homeless status	1.79	(−2.18 to 5.76)	0.21	(−0.78 to 1.21)
Health insurance	−4.39	(−7.65 to −1.13)	−0.58	(−1.27 to 0.11)

Table 3. Percentages for treatment contact and completion among intervention and control groups.

	Treatment Contact*				Treatment Completion†			
	Control		Intervention		Control		Intervention	
Programs	**%**	**95% CI**	**%**	**95% CI**	**%**	**95% CI**	**%**	**95% CI**
Outpatient	7	(5–10)	7	(5–10)	63	(44–78)	80	(60–91)
Inpatient	6	(4–9)	4	(2–6)	87	(67–96)	100	(71–104)
Residential	2	(0–3)	2	(1–4)	100	(55–105)	71	(35–92)
Detox	5	(3–7)	5	(3–8)	78	(54–91)	67	(44–84)
Alcoholics Anonymous	11	(7–14)	13	(9–16)	—	—	—	—
Any of above	20	(16–24)	21	(17–26)	78	(64–87)	75	(60–85)

Two hundred eighty patients reported receiving a treatment referral (140 intervention, 140 control). Only cases with valid data for contact and completion are included.
*Proportions based on n=361 for control group and n=338 for treatment group; CIs were calculated using the Wald method.
†Proportions for treatment completion are calculated using on the number of patients with contact in each treatment category as the denominator; CIs were calculated with the Adjusted Wald method for small sample sizes.

Table 4. Effects of the Brief Negotiated Interview on drinking behavior at 3 months, separately by baseline CAGE score.

	Typical Weekly Drinks				Maximum Drinks			
	CAGE <2		CAGE >2		CAGE <2		CAGE >2	
Predictors	**B**	**CI**	**B**	**CI**	**B**	**CI**	**B**	**CI**
Intercept	12.43	(4.77–20.08)	19.97	(12.25–27.69)	4.37	(2.43–6.31)	6.31	(4.49–8.13)
Brief Negotiated Interview	−2.80	(−5.03 to −0.56)	−3.93	(−8.11 to 0.24)	−1.23	(−2.05 to −0.42)	−0.35	(−1.30 to 0.61)
Baseline drinks	0.30	(0.09–0.52)	0.23	(0.16–0.31)	0.37	(0.23–0.52)	0.32	(0.21–0.44)
Female	−2.26	(−3.94 to −0.59)	0.22	(−5.91 to 6.35)	−0.30	(−1.38 to 0.77)	0.06	(−0.89 to 1.01)
Hispanic	−3.90	(−7.15 to −0.66)	−12.56	(−17.82 to −7.29)	−0.98	(−1.77 to −0.19)	−2.86	(−3.98 to −1.74)
Black	0.07	(−2.81 to 2.96)	−2.00	(−8.19 to 4.19)	−0.72	(−1.73 to 0.29)	−1.47	(−2.41 to −0.53)
Other race	−4.48	(−11.96 to 3.00)	−0.57	(−10.36 to 9.21)	−0.89	(−2.56 to 0.79)	−0.16	(−1.72 to 1.40)
Education	−0.37	(−1.68 to 0.94)	−0.29	(−1.31 to 1.89)	0.18	(−0.26 to 0.63)	−0.11	(−0.48 to 0.27)
Homeless status	15.85	(−13.43 to 45.13)	−0.51	(−4.34 to 3.31)	0.81	(−1.82 to 3.45)	−0.06	(−1.33 to 1.20)
Health insurance	−1.73	(−4.08 to 0.61)	−5.79	(−10.65 to −0.93)	−0.71	(−1.51 to 0.10)	−0.47	(−1.27 to 0.33)

exceeded low-risk limits at follow-up compared with 18.6% of CAGE less than 2 controls (Δ 18.6%; 95% CI 11.5% to 25.6%), whereas 18.3% and 20.3% of CAGE greater than 2 control and intervention patients, respectively, no longer exceeded low-risk limits at 3 months (2.0%; 95% CI −9.1% to 13.2%; $\chi^2=0.4$; $df=1$, nonsignificant).

We also examined the potential for differential effects of the intervention among patients of differing ages, race/ethnicity, marital status, education, insurance status, and homeless status by adding product terms for the interaction of these variables and Brief Negotiated Interview status to equation 1. These analyses revealed no differences in the effects of the Brief Negotiated Interview by age, race/ethnicity, marital status, insurance status, and homeless status, although this study may not be adequately powered to detect these conditional effects. However, significant differences in the response to the Brief Negotiated Interview were observed according to level of education. The product term for the interaction of Brief Negotiated Interview×education revealed significantly greater decreases in both number of drinks per week and the maximum number of drinks per occasion among those with higher levels of education. The average decrease in the typical number of drinks per week among patients who attended or graduated from college was

5.5, compared with an average decrease of 1.7 for high school graduates and below (data not shown). A similar pattern was observed for differences in the effects of the intervention on the maximum number of drinks per occasion by level of education (intervention effects among some college and above = −1.2; among high school and below = −0.4).

LIMITATIONS

This study has several limitations. We used a quasiexperimental design that was randomized only by time sequence, not *within* time sequence. This design was chosen in an effort to minimize the threat of contamination attributable to the training of ED staff in the Brief Negotiated Interview before the enrollment of controls, which we deemed a much greater threat to validity than the absence of randomization within each period. Also, patient recruitment was limited by the availability of research staff at each of the sites, which may have resulted in a type of selection bias. It took longer to enroll the intervention group because it was necessary to have a trained provider on duty to enroll participants. Nevertheless, the data presented in Table 1A and B indicate that sequential assignment to intervention and control conditions produced comparable experimental groups.

It is possible that self-reported alcohol consumption allows the participant to report fewer drinks than actually consumed to "look good" to the interviewer (social acceptability). To investigate the possible impact of social acceptability bias on our results, sensitivity analyses inflating levels of drinking at 3 months among the intervention group revealed that a 5% increase would eliminate the intervention effect for maximum drinks per occasion, whereas a 10% increase in typical drinks per week at 3 months would eliminate the intervention effect for that outcome. An attempt to limit the social desirability reporting bias was the use of the interactive voice response system, which eliminates the potential for interaction with a live person to alter responses and has shown excellent validity and reliability in studies of alcohol use.[41,42]

Another concern was that some of the reduction in drinking from baseline to follow-up could be due to assessment reactivity (ie, the impact of answering screening and assessment questions on drinking and alcohol-related consequences), which may have resulted in the decreases in alcohol consumption observed among both experimental groups from baseline to 3 months. Because both experimental groups completed identical baseline and follow-up instruments, assessment reactivity would not likely account for observed intervention effects but could reduce effect size.

Despite the relatively brief recruitment periods for each experimental condition, the later recruitment of intervention patients (ie, stretching into the summer at some sites) might have allowed estimates of intervention effects to be affected by seasonal variability in drinking patterns.[40] Given the absence of baseline differences in alcohol use between intervention and control patients (Table 1B), this possibility is highly unlikely. To further investigate, we modeled the number of drinks per week and maximum number of drinks per occasion measured at baseline as outcomes in an equation containing enrollment date (April 1 = day 1), intervention group, and dummy variables for site as predictors. (Baseline drinking measures were used as outcomes in this analysis because of the confounding of intervention effects and time in predicting drinking behavior at follow-up.) No effect of time on either measure of alcohol use was observed (data not shown).

Exclusive reliance on self-reported drinking is also a limitation, although such measures have been the criterion standard in alcohol research. There is evidence in the literature that self-reported drinking measures are reliable and that telephone interviews correlate with face-to-face interviews as well as information collected from collaterals.[43-46] There are only a few studies that have reported limited data about the use of collaterals. Collaterals reported lower alcohol consumption than subjects in intervention and control groups.[46] The reliability of the follow-up questionnaire may have been increased by use of a more sensitive measure such as the time-line follow back tool, however.[47] Finally, an additional limitation associated with this study design is the shift in data collection methods from personal interview at baseline to interactive voice response at follow-up. Although there is evidence that personal interview methods may lead to underreporting of use relative to automated approaches,[43] the fact that data collection procedures were invariant across experimental groups should yield unbiased estimates of intervention effects.

An additional limitation is that adherence to the protocol and fidelity of the intervention cannot be totally assured. The participants received both didactic information and a skills-based session, with definitive critical actions outlined, as well as laminated cards to ensure that provider drift would not occur. This combination of didactic and skills-based sessions has been shown to improve emergency medicine residents' practice.[48] Future use of audio-taping with independent raters would better determine adherence but require a substantial increase in funding.

Finally, the 3-month follow-up rate is lower than desired and is primarily attributable to the transient nature of the ED study population. However, this is also a function of the translational character of this study, which requires real-world conditions for implementation (eg, homeless patients, dependent drinkers, those without telephones). Participation of patients from a diverse group of medical institutions was critical to demonstrating the ability to translate this intervention to real-life ED settings.

DISCUSSION

Brief interventions by primary care providers have been shown to be an efficacious and cost-effective modality for eliminating or reducing harmful health behaviors related to alcohol abuse.[12,49-52] However, these techniques are used infrequently by ED staff, despite a substantial number of patients with alcohol problems.[38,53] The current multicenter study is the first to demonstrate efficacy of an ED provider intervention across a diverse group of ED practices, clinicians, and patients. Our results indicate that exposure to the Brief Negotiated Interview is associated with decreases in reported alcohol use among ED patients who are at-risk drinkers. At the 3-month follow-up, 28% of patients in the intervention group

no longer exceeded National Institute of Alcohol Abuse and Alcoholism low-risk limits compared with 18% of the control group. We observed an average reduction of approximately 3.25 drinks per week among participants receiving the Brief Negotiated Interview relative to controls. Our findings compare favorably with results from a recent meta-analysis of the efficacy of brief interventions in primary care settings (decreases of roughly 4 drinks per week).[12,52] It is still unclear whether the modest benefit obtained at 3 months will be maintained at 6 or 12 months in this ED population. In fact, recent meta-analyses have shown that results of brief motivational interviewing in the clinical setting are more robust at 3 months and then tend to decline.[32,35] Referral to primary care or other settings for further screening and a booster Brief Negotiated Interview would be in order for patients drinking above low-risk guidelines, whereas a system for successful referral to specialized treatment for dependent drinking is likely necessary to achieve sustained effects.

The potential clinical and public health significance of these findings is considerable. Substantial reductions in the number of patients exhibiting at-risk drinking patterns were observed at 3 months, particularly among those who were not likely to be alcohol dependent at baseline. Lower rates of at-risk drinking might foster substantial reductions in alcohol-related illness, injury, and ED use over the longer term. Were brief interventions in the ED universally practiced, our results, coupled with data from the Medical Expenditure Panel Survey, suggest that a reduction of nearly 33 million drinks per week among ED patients who are at-risk drinkers could be possible (26% of 38,616,388 patients=10 million patients×3.25 drinks per week=32.5 million drinks per week).[53,54]

The effectiveness of the Brief Negotiated Interview was mainly confined to at-risk drinkers as opposed to those with greater severity, using CAGE greater than 2 as a marker for possible dependency, a finding that has been reported previously.[24] Although the reduction in drinks per week among dependent drinkers was slightly larger than the reduction among risky drinkers, a reduction of 3 to 4 drinks per week is not clinically meaningful for dependent drinkers with base rates of consumption 10 times that amount. The lack of clinically meaningful reductions among dependent drinkers highlights the importance of more accessible, intensive treatment programs for this population. In clinical practice, ED providers do not generally have the time to arrange for alcohol treatment program placement while delivering patient care. As such, provider-initiated alcohol treatment referrals are uncommon.[53] The involvement of "extenders" in the delivery of services to this population to support interventions by providers—eg, social workers, peer health advocates, nurse specialists—may improve the likelihood of getting a dependent drinker into treatment.[23,55,56] Data from Project ASSERT, which employed peer health educators to provide screening, patient motivation, and a direct linkage to treatment, provide evidence to support the efficacy of clinical extenders.[23,56]

The other conditional effect observed in this analysis—greater efficacy of the Brief Negotiated Interview among those with higher education—was not at all surprising, given the cognitively driven intervention. However, in the context of deficits in treatment seeking and treatment efficacy among at-risk drinkers with lower levels of education,[57,58] this finding highlights the pressing need for treatments and interventions capable of modifying drinking behavior among less educated patients.

Despite a reduction in overall drinks, the intervention was not associated with participation in or completion of an alcohol treatment program. This finding may be attributable to the design of the study because this was not a comparison of intervention subjects with *untreated* controls but rather a contrast between 2 interventions (screening and informational handout versus screening, handout, and Brief Negotiated Interview). The screening and referral list received by all patients may have been enough to prompt patients to seek treatment. One way to view these results is to see the shared screening and referral for treatment components of these interventions as equally effective in promoting help-seeking.

Future studies will need to address intervention delivery vehicles, which may include ED staff (ie, peer educators, physicians, nurses, social workers) or other computerized models and booklets suggested by Blow et al.[22] The exact messages themselves also need to be addressed, including content and length, as well as whether these messages should be tailored to different patient profiles, including, for example, demographic characteristics (age, sex, ethnicity, educational level) and reason for ED visit (illness or injury).

In conclusion, the results of this translational research study demonstrate the efficacy of the Brief Negotiated Interview across 14 diverse ED settings and patient populations and should provide impetus for broader implementation by providers. Widespread use of the Brief Negotiated Interview in EDs has the potential to significantly reduce unhealthy alcohol use, resulting in improvements to public health.[54]

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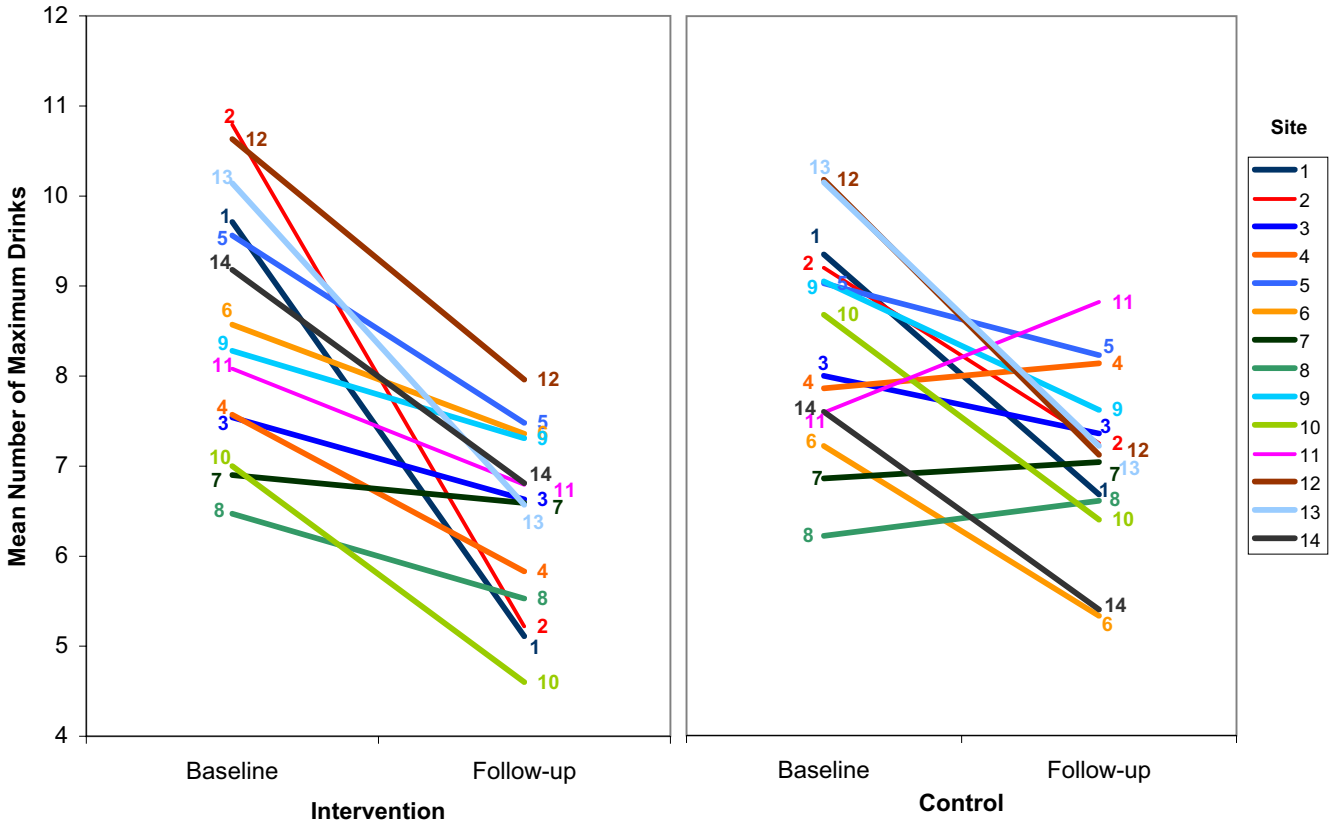

Figure E1. Change in mean number of maximum drinks per occasion baseline to follow-up

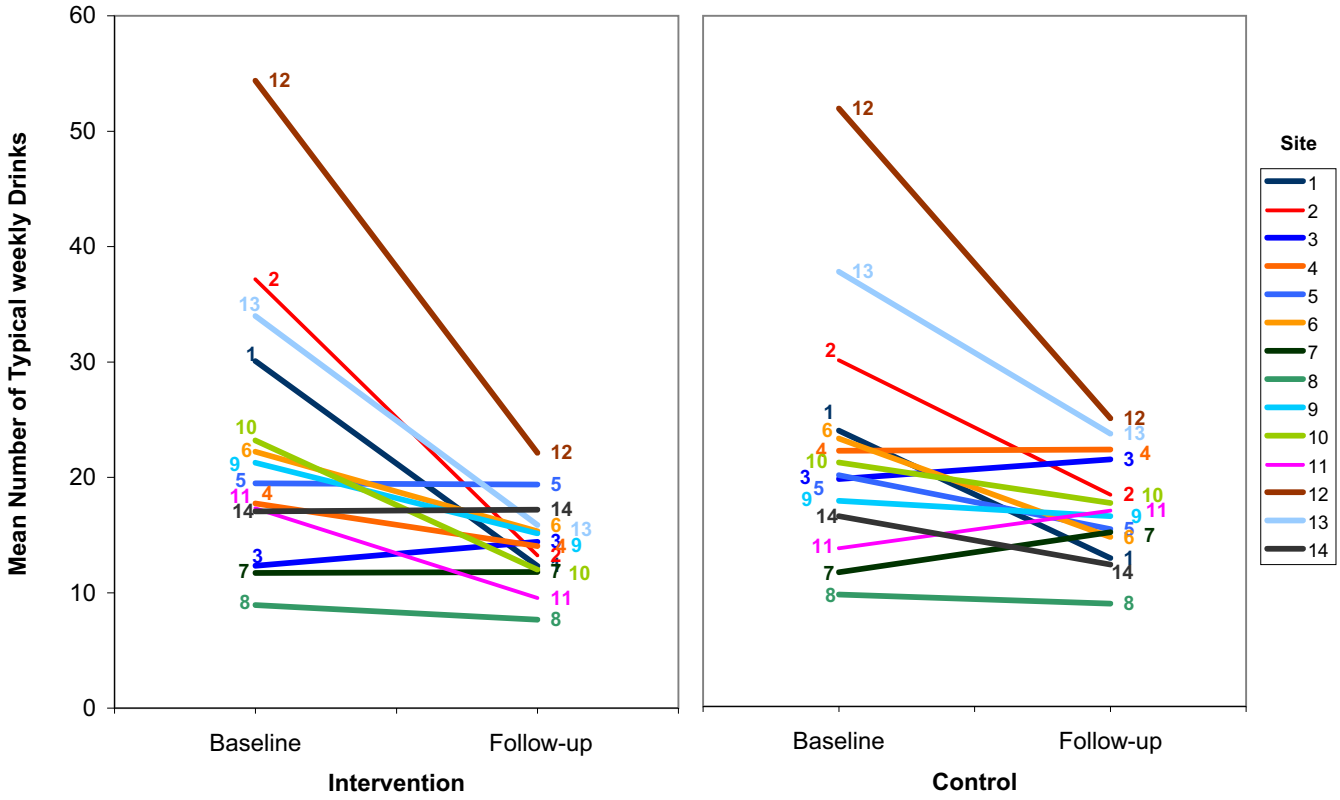

Figure E2. Change in mean number of typical weekly drinks baseline to follow-up

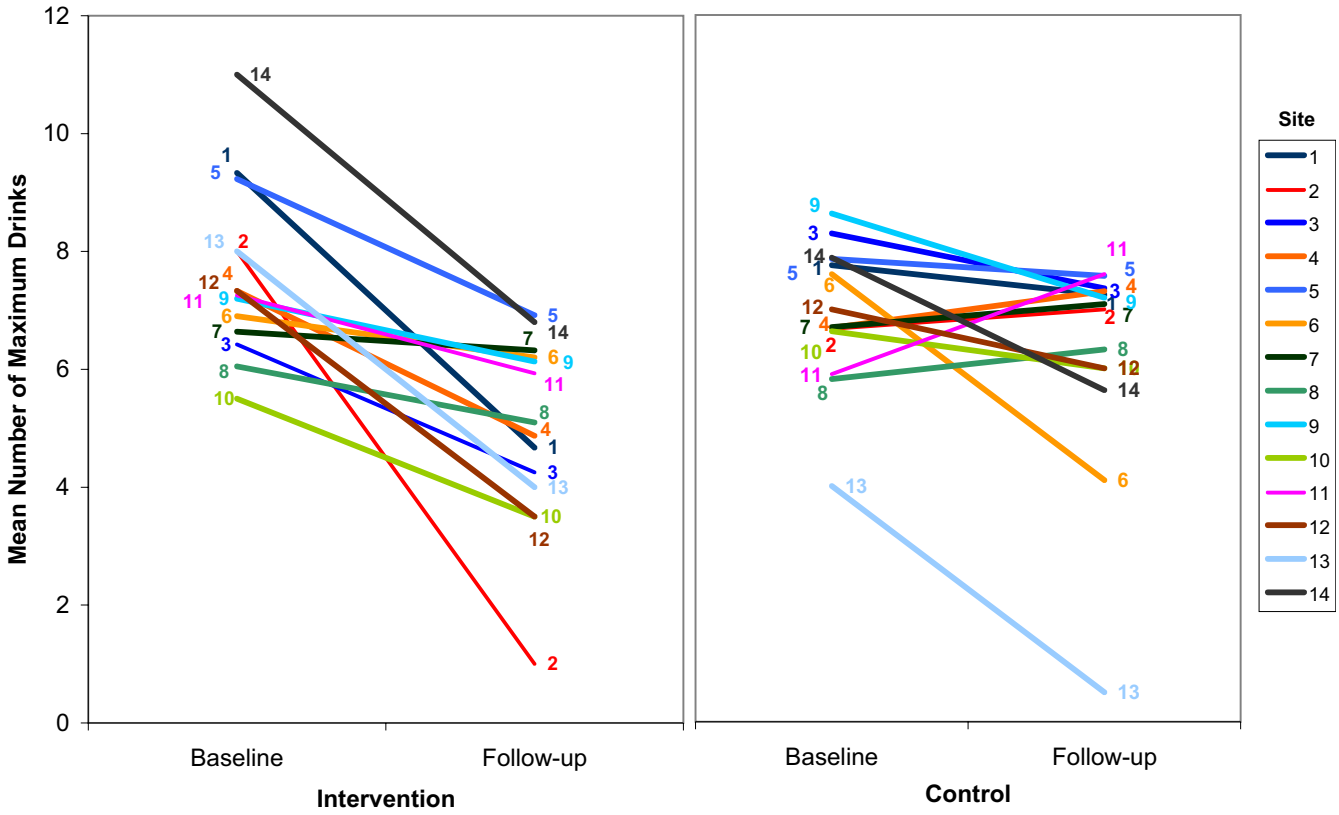

Figure E3. Change in mean number of maximum drinks per occasion for CAGE < 2: Baseline to follow-up

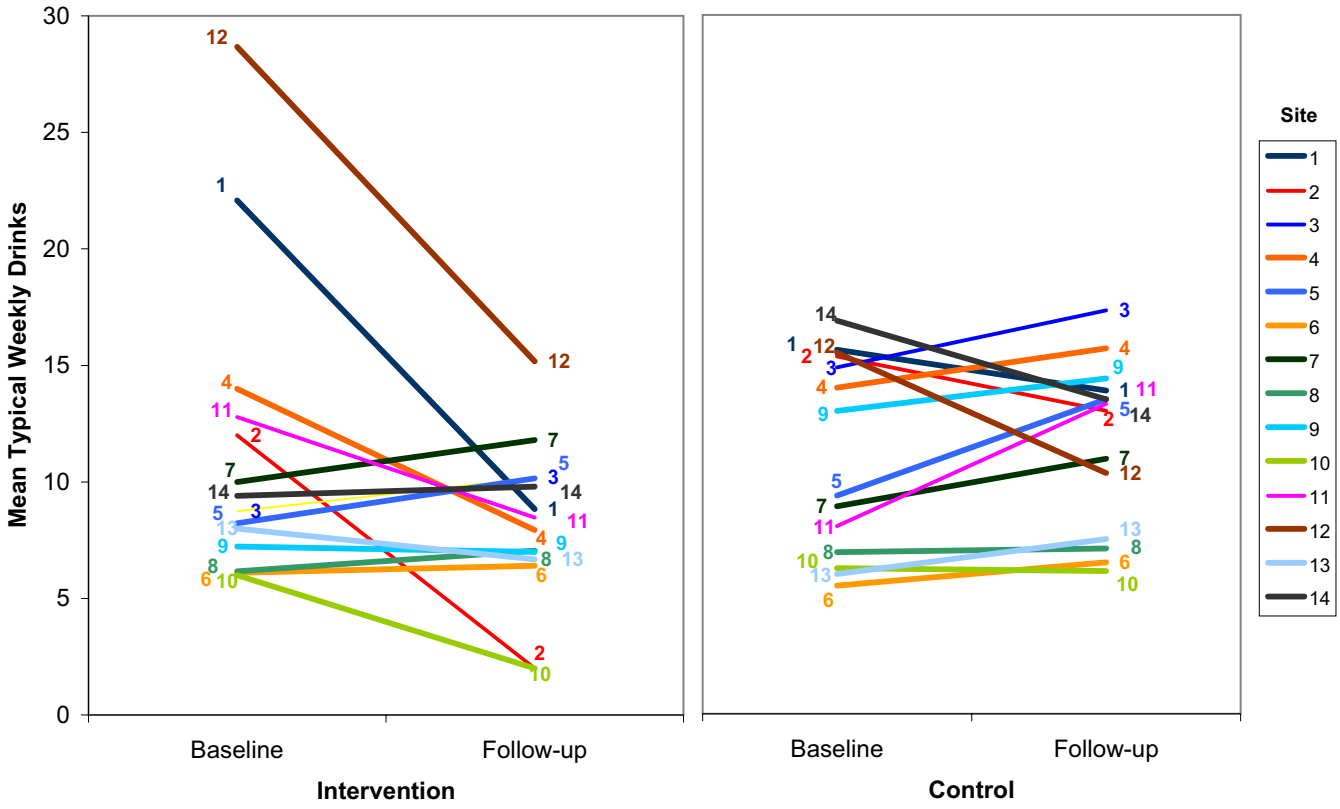

Figure E4. Change in mean number of typical weekly drinks for CAGE < 2: Baseline to follow-up

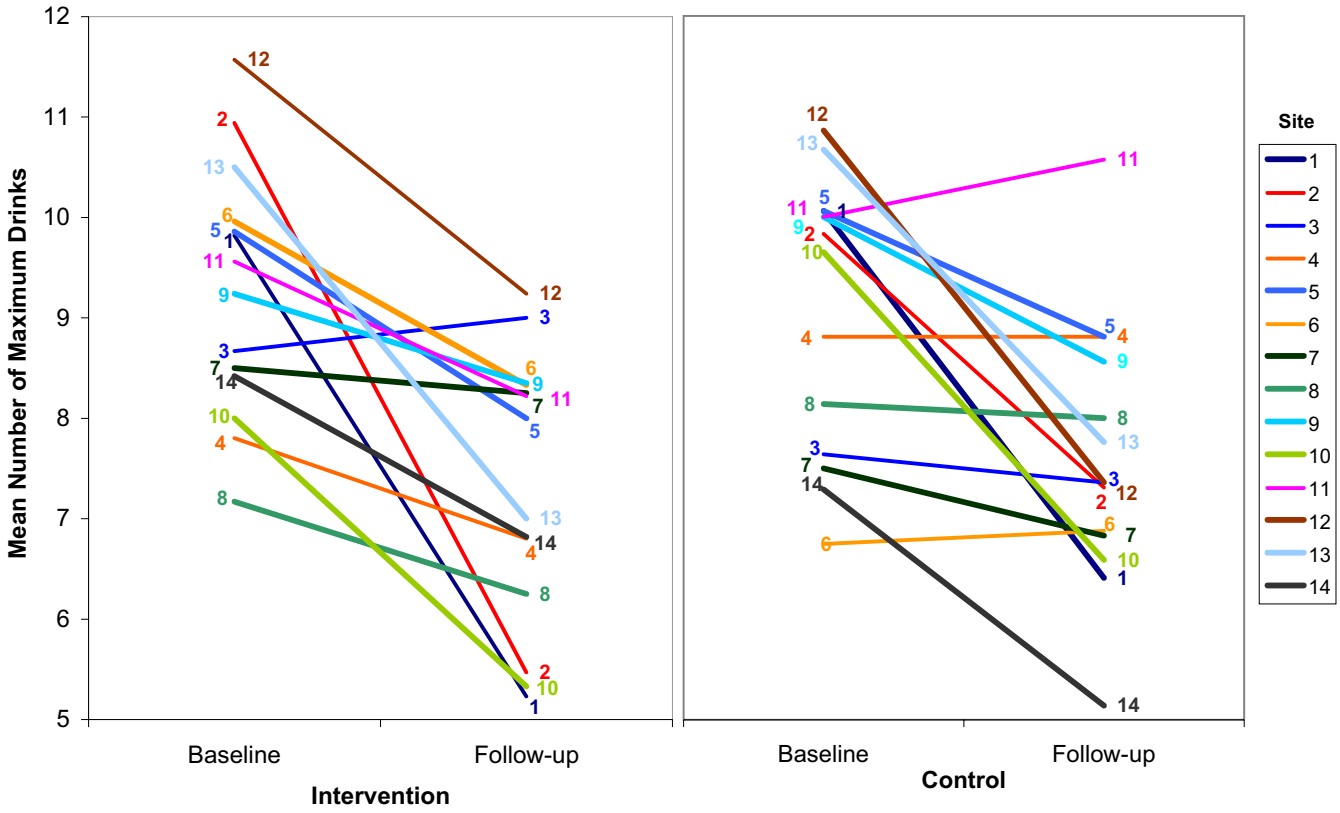

Figure E5. Change in mean number of maximum drinks per occasion for CAGE 2+: Baseline to follow-up

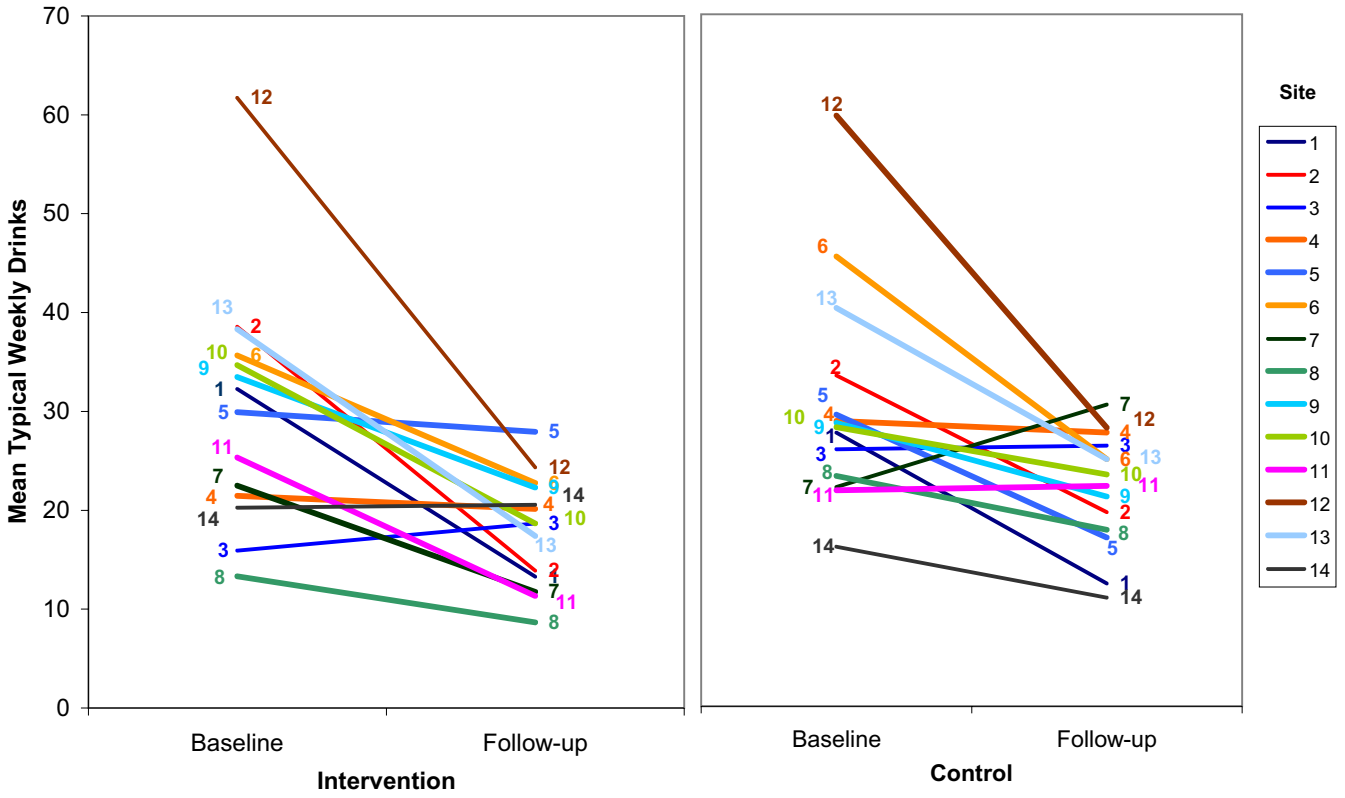

Figure E6. Change in mean number of typical weekly drinks for CAGE 2+: Baseline to follow-up

Table E1. National Alcohol Screening Day (NASD) patient screening form (Abridged version).

For the next 7 questions, check the box that best describes your answer for the period covering the past 12 months.

1. On average, how many days a week do you drink alcohol (for example: beer, wine or liquor)?
○ None ○ Less than 1 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

2. On a typical day when you drink, how many drinks* do you have? ** A drink is defined as one 12-ounce bottle of beer or wine cooler, one 5-ounce glass of wine, or 1.5 ounces of distilled spirits.*
○ None ○ 1 ○2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10 ○ 11 ○ 12+

3. What is the maximum number of drinks you had on any given day in the past month?
○ None ○ 1 ○2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10 ○ 11 ○ 12+

4. Have you ever felt that you should cut down on your drinking? ○ Yes ○ No

5. Have people annoyed you by criticizing your drinking? ○ Yes ○ No

6. Have you ever felt bad or guilty about your drinking? ○ Yes ○ No

7. Have you ever had a drink first thing in the morning to steady your nerves or get rid of a hangover? ○ Yes ○ No

Table E2. NIAAA Guidelines for low-risk drinking.

	# STANDARD DRINKS FOR LOW-RISK DRINKING	
	Per Week	**Per Occasion**
Men	≤14	≤4
Women	≤7	≤3
All 65 or older	≤7	≤1
		Per day