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A Text Message Alcohol Intervention for Young Adult Emergency Department Patients: A Randomized Clinical Trial

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Abstract

Objective—Opportunistic brief in-person Emergency Department (ED) interventions can be effective at reducing hazardous alcohol use in young adult drinkers, but require resources frequently unavailable. Mobile phone text messaging (SMS) could sustainably deliver behavioral support to young adult patients, but efficacy remains unknown. We report 3-month outcome data of a randomized controlled trial testing a novel SMS-delivered intervention in hazardous drinking young adults.

Methods—We randomized 765 young adult ED patients who screened positive for past hazardous alcohol use to one of three groups: SMS Assessments + Feedback (SA+F) intervention who were asked to respond to drinking-related queries and received realtime feedback through SMS each Thursday and Sunday for 12 weeks (n=384); SMS Assessments (SA) who were asked to respond to alcohol consumption queries each Sunday but did not receive any feedback (N=196); and a control group who did not participate in any SMS (n=185). Primary outcomes were number of binge drinking days and number of drinks per drinking day in the past 30 days collected by web-based Timeline Follow-Back method and analyzed with regression models. Secondary

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Author contributions: BS conceived the study, designed the trial, and obtained research funding. BS, JK, CWC, and DBC supervised the conduct of the trial and data collection. BS and JK undertook recruitment of participating centers and patients and managed the data, including quality control. KHK, TC and PMM provided statistical advice on study design and analyzed the data; CWC chaired the data oversight committee. BS drafted the manuscript, and all authors contributed substantially to its revision. BS takes responsibility for the paper as a whole

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outcomes were the proportion of participants with weekend binge episodes and most drinks consumed per drinking occasion over 12 weekends collected by SMS.

Results—Using web-based data, there were decreases in the number of binge drinking days from baseline to 3 months in the SA+F group (-.51 [95% confidence interval {CI} -.10 to -.95]), whereas there were increases in the SA group (.90 [95% CI .23 to 1.6]) and the control group (.41 [95% CI -.20 to 1.0]). There were also decreases in the number of drinks per drinking day from baseline to 3 months in the SA+F group (-.31 [95% CI -.07 to -.55]), whereas there were increases in the SA group (.10 [95% CI -.27 to .47]) and the control group (.39 [95% CI .06 to .72]). Using SMS data, there was a lower mean proportion of SA+F participants reporting a weekend binge over 12 weeks (30.5% [95% CI 25% to 36%) compared to the SA participants (47.7% [95% CI 40% to 56%]). There was also a lower mean drinks consumed per weekend over 12 weeks in the SA+F group (3.2 [95%CI 2.6 to 3.7]) compared to the SA group (4.8 [95% CI 4.0 to 5.6]).

Conclusion—A text message intervention can produce small reductions in binge drinking and the number of drinks consumed per drinking day in hazardous drinking young adults after ED discharge.

Introduction

Background

Each day in the US, over 50,000 young adults 18-24 years of age visit an emergency department (ED).[1] A quarter of young adults use the ED for primary care[2] and up to a half have hazardous alcohol use patterns[3]. For these reasons, the ED provides an opportunity to identify young adults with hazardous alcohol use and intervene to prevent associated risks.[4] Routine screening, brief intervention and referral to treatment (SBIRT) for hazardous alcohol use is promoted by the American College of Emergency Physicians[5] and mandated in Level I trauma centers by the American College of Surgeons[6]. Despite this recommendation, only around 15% of Level I trauma center EDs incorporate routine SBIRT.[7] Numerous barriers exist to widespread implementation[8], and brief interventions delivered in the ED setting have produced mixed findings[9].

One promising modality that could assist effective delivery of brief interventions for alcohol use, especially among young adult ED patients, is mobile phone text messaging (short message service: SMS). Ninety five percent of young adults own a mobile phone and 97% of these use SMS, either sending or receiving an average of 50 texts per day.[10] SMS has been used to promote health in a wide range of young adult health issues, including diabetes[11], asthma[12], and cigarette smoking[13]. In theory, SMS-delivered alcohol interventions could reduce the need for training providers to deliver alcohol interventions, provide uniform protocols, reach large numbers of persons, and do so in a cost-efficient manner. Furthermore, a text-message based intervention can reach young adults in the natural environment where they are making drinking choices, potentially increasing saliency. No adequately powered trial published to date has studied the effect of an SMS intervention to reduce alcohol use in young adults.

Goals of this Investigation

We conducted the Texting to Reduce Alcohol Consumption (TRAC) Trial to evaluate the efficacy of a 12-week SMS intervention that encourage lower alcohol consumption, specifically binge drinking (≥5 drinks per occasion for men and ≥4 drinks per occasion for women) among young adults. We focused on reducing binge drinking because of its association with 80,000 deaths in the U.S. each year[14] and a range of social problems, such as motor vehicle crashes and interpersonal violence[15]. We hypothesized that in young adults who screen positive for hazardous drinking, there would be greater reductions in both binge drinking and drinks consumed per drinking episode after exposure to an SMS intervention incorporating weekly SMS drinking Assessments with real-time Feedback (SA+F) compared to SMS drinking Assessments without feedback (SA) or a control condition.

Importance

A text message-delivered intervention that effectively reduces binge drinking could provide a scalable option for EDs to incorporate into SBIRT for hazardous drinking young adults.

Methods

Study Design and Setting

The TRAC trial was a three-arm randomized controlled trial that took place at four urban teaching hospitals in Pittsburgh, Pennsylvania including two Level I trauma centers (UPMC Mercy & Presbyterian Hospital) and two non-trauma centers (UPMC Shadyside & Magee Women's Hospital). The University of Pittsburgh Institutional Review Board approved study procedures. The trial was registered at http://www.clinicaltrials.gov:NCT01688245 and the protocol is described in detail in a prior publication[16].

ED patients aged 18-25 years who presented between 7 am and 1 am, 7 days per week (November 2012-November 2013) identified from the electronic triage log were eligible for screening. Young adults who were medically stable, not seeking treatment for drugs or alcohol, and who gave permission to their emergency physician were approached by research assistants in treatment spaces. Interested patients who speak English and had not been enrolled in any alcohol-related study in the prior year self-administered a 5-minute computerized survey. Patients reporting hazardous alcohol consumption (Alcohol Use Disorder Identification Test for Consumption: AUDIT-C scores of ≥3 for women or ≥4 for men)[17] were eligible to participate in the trial. Exclusion criteria included the following: past treatment for drug use or psychiatric disorders, no cell phone ownership with text messaging. Patients who met enrollment criteria and who were interested underwent written informed consent. Any patient who screened positive on the AUDIT-C, regardless of eligibility or interest, was offered a list of local alcohol treatment resources.

After providing written informed consent, participants self-administered computerized baseline assessments in the ED, which took an average of 10 minutes to complete ($10 remuneration). Prior to randomization, the research associates checked completion of the baseline survey. Those reporting current high school enrollment were excluded, due to concerns about parental influence on outcomes[18]. Eligible participants who completed the

baseline survey were randomly assigned to 1 of 3 groups: an intervention incorporating weekly SMS drinking-related Assessments with real-time Feedback (SA+F); SMS drinking Assessments (SA); or control. Randomization sequences were allocated in a 2 SA+F: 1 SA: 1 control ratio to allow for more observations in the intervention group to allow for later analysis of mechanisms of change. Randomization was generated in blocks of 8 for each recruitment site by a computer-generated algorithm and allocated electronically. Research associates were blinded to treatment allocation to minimize bias. Participants were told that they could either receive no texts, Sunday texts for 12 weeks or both Thursday and Sunday texts for 12 weeks. Three months after randomization, all participants received text messages and emails with a hyperlink to a web-based follow-up questionnaire ($20 remuneration).

Baseline & Follow-up Assessments

The baseline assessment collected demographic information (e.g., age, sex, race, ethnicity, current school enrollment, living arrangement, and employment status) and substance use severity in the past 3 months using the NIDA Modified Alcohol, Smoking and Substance Involvement Screening Test (NM ASSIST). The NM ASSIST was adapted from the World Health Organization Alcohol, Smoking and Substance Involvement Screening Test (ASSIST), Version 3.0 (http://www.drugabuse.gov/nmassist/)[19]. Reasons for ED visits (chief complaint) were taken from the electronic triage dashboard and treating physicians were asked whether ED visits were related to alcohol use.

At baseline and at 3-month follow-up, the Timeline Follow Back (TLFB) procedure[20] was used to collect self-report of alcohol use frequency, quantity (on a drinking day), and binge drinking (≥5 drinks for men and ≥4 drinks for women). Using a web-based TLFB calendar[21], participants provided retrospective estimates of their daily drinking in the 30 days prior to the assessment. Memory aids were used to enhance recall (e.g., visual calendar with key dates and holidays serve as anchors for reporting drinking; a visual chart of standard drink sizes reduces variability in quantity).

SMS Intervention

The SMS Assessments + Feedback (SA+F) intervention is based on that used in our prior pilot trial[22], further developed by a multi-disciplinary team of emergency physicians (BS, CC) and alcohol treatment specialists (DC, PM) using feedback from young adult drinkers. In brief, SA+F aims to increase awareness of drinking intentions and behavior and increase goal-striving and goal-attainment toward reduced alcohol consumption. The SA+F uses elements of the Health Belief Model[23], the Information Motivation Behavior model[24], and the Theory of Reasoned Action[25] and targets the following key determinants of drinking behavior: intention to binge drink, knowledge of health risks associated with binge drinking, norms of drinking by participant age group, skills to reduce binge drinking and goal commitment to avoid a binge day. The style and tone of messages attempted to reflect those used in motivational interviewing[26]. SMS queries were delivered on Thursday (proximal to typical binge drinking days)[27] and on Sunday (to reduce recall bias in recall of weekend drinking behavior)[28].

SA+F participants received a series of welcome text messages within 1 hour of enrollment describing what to expect over the course of intervention exposure. Each Thursday, for 12-weeks, they were sent a text asking them to report their weekend drinking plans. If they reported anticipating a heavy drinking day, they were then asked whether they were willing to set a low-risk drinking goal (<5 drinks per occasion for men or <4 drinks per occasion for women). Depending on the response to each query, participants were provided with real-time text feedback to either strengthen their low-risk drinking plan or goal, or alternately, to promote reflection on their drinking plan or decision not to set a low risk goal. Then, on Sunday, participants were sent a text asking them to report the most drinks they had during a single occasion over the weekend. Depending on their response, they were provided with text feedback to either support their low-risk drinking behavior or to promote reflection on their binge-drinking behavior. (For detailed flow chart of the SMS intervention and sample messages, see Appendix).

Participants in the SMS Assessments (SA) group did not receive any pre-weekend text message assessments but received identical text drinking assessments each Sunday for 12-weeks without receiving any alcohol-related feedback. The SA group is critical to separate the effect of the intervention from that associated with potential drinking assessment reactivity from asking participants to report their alcohol consumption each week for 12 weeks.[29] Any text message received outside the range of expected responses resulted in an email sent to the investigators to review. Participants in the control condition did not participate in any SMS.

Sample Size

For power consideration, we focused on detecting the difference between SA+F and control groups in binge drinking days at up to 9-months follow-up. Using 3-month outcome data from our pilot trial[22], and assuming a 35% reduction in intervention effect at 9-months, we estimated a mean reduction in the number of binge drinking days of 2.0 (SD 5.4) in the intervention group and a reduction of 0 (SD 4.1) in the control group. Assuming an attrition of 35% at 9-months, 750 total participants (375 SA+F: 187 SA: 187 control) were needed to have 80% power to show a difference at significant level = 0.05 based on two-sided two sample test with repeated measures. We included an assessment only (SA) group to allow us to separate the effect of text message feedback from frequent drinking assessments. We allocated participants in a 2 SA+F:1:SA:1 control ratio to allow more observations in the intervention group to allow for future examination of mediators and moderators of effect. Given the automated nature of the intervention, we considered any reduction in binge drinking clinically significant.

Statistical analysis

All analysis was conducted using STATA statistical software, version 13.1. Web-based TLFB data were analyzed as primary outcomes. Number of binge drinking episodes in the past 30 days were analyzed using Zero-inflated Poisson (ZIP) regressions due to the data being left skewed with many zero-counts, where the variance is greater than the mean (over-dispersion). Using a mixture distribution method such as a ZIP model solves the problem of zero-count inflation and prevents the zero-counts from dominating the distribution[30]. Drinks

per drinking day over the past 30 days using web-based TLFB data were analyzed using negative binomial regression analysis to handle over-dispersion (where observed variance is larger than expected variance of the count (drinks per drinking day) data.

In each model, we adjusted for covariates shown to be associated with drinking outcomes, including baseline (past 30-day) alcohol consumption[31], sex (male; female)[32], age (in years)[33], race (white; black; other)[34], and college enrolled (yes; no)[35]. We also included site of enrollment (UPMC Mercy; Presbyterian; Shadyside; Magee) as a covariate to control for site differences in patient characteristics. Model fit was determined through Pearson goodness-of-fit tests.

The data were examined for outliers and influential diagnostics. Sensitivity analyses were performed by comparing the results of the regression analyses with bootstrapping (1000 replications using bias-corrected and accelerated confidence intervals). Similar results were found for regression analyses and bootstrapping, hence, regular regression analyses are reported.

To determine the potential effect of attrition bias, a multiple imputation was performed using fully conditional specification. Both ZIP and negative binomial regressions were performed with an additional predictor (complete or incomplete case). A summary of negative binomial regression through MI ESTIMATE command in STATA generated an average result of 10 imputations. The primary outcomes are presented using listwise deletion and imputation procedures.

Differences in number of binge drinking episodes in the past 30 days between treatment conditions are presented as means and from multivariable models as incident rate ratios (IRRs). IRRs are the incidence for the intervention divided by the incidence rate for the control. An incidence rate ratio is interpreted in a similar fashion to an odds ratio, but is over a discrete time interval of a month (30 days). Differences in class membership for any past 30-day binge episode are presented as odds rate ratios (ORs).

SMS-based weekly data were analyzed as secondary outcomes. The proportions of participants with a weekend binge episode over 12 weekends were analyzed using chi-squared tests and the mean of maximum drinks consumed per drinking occasion over 12 weekends were analyzed using Student's t-tests. All primary and secondary outcomes are presented with 95% confidence intervals (95% CI).

Results

Screening and Randomization

Participant flow is presented in Figure 1. Among 4141 potentially eligible patients presenting during recruitment, 3879 were approached and 3061 completed screening. Patients who completed the screen did not differ in age or sex from those who did not complete it. Of those patients screened, 1103 (36%) scored positive for hazardous drinking. Among those with hazardous drinking, an additional 82 were excluded due to prior treatment for drug or psychiatric disease and no mobile phone ownership. 1021 patients

were eligible and 858 (84%) were interested in trial participation and completed informed consent. Females were less likely to refuse participation in the RCT (male, 20.9%; female, 12.8%). Furthermore, African Americans were less likely to refuse than other races/ethnicities (African American, 8.8%; other, 20.5%). Post-enrollment but prior to randomization, an additional 93 were excluded due to incomplete baseline assessments (n=78) or reporting current high school enrollment (n=14). This left 765 patients randomized to the SA+F (n=384) group, SA group (n=196), or control group (n=185). As shown in Table 1, there were no baseline differences between groups on any of the demographic, substance use, and medical variables examined.

Text Message Response Rates

Overall, the mean percentage of SA+F participants responding to Thursday SMS queries was 81% (95% CI 77% to 85%), with the responses decreasing from 93% (95% CI 90% to 95%) on week 1 to 71% (95% CI 66% to 76%) on week 12 (Figure 2). The mean percentage of SA+F participants responding to Sunday SMS queries was 77% (95% CI 73% to 81%), with the responses decreasing from 91% (95% CI 88% to 94%) on week 1 to 66% (95% CI 61% to 71%) on week 12. Overall, the mean percentage of SA participants responding to Sunday SMS queries was 79%, with responses decreasing from 93% on week 1 to 73% on week 12, with no differences in attrition from the SA+F group.

Web-based Follow-up Assessment

Follow-up data were obtained through web-based surveys from 598 participants (78%) at 3-months. There were no differences in attrition among treatment conditions, with follow-up in SA+F at 76% (95% CI 71%-80%), SA at 82% (95% CI 75%-87%) and control at 80% (95% CI 74%-86%). Compared to participants who completed follow-up, those lost-to-follow-up were more likely to be African American (54% vs. 40%), not currently enrolled in college (72% vs. 50%), and with baseline higher number of binge days (mean (SD): 5.1 (6.2) vs. 3.5 (2.9)).

Web-Based TLFB Binge Drinking

Using web-based data, there were decreases in the number of binge drinking days from baseline to 3 months in the SA+F group (-.51 [95% confidence interval {CI} -.10 to -.95]), whereas there were increases in the SA group (.90 [95% CI .23 to 1.6]) and the control group (.41 [95% CI -.20 to 1.0]). There were also decreases in the number of drinks per drinking day from baseline to 3 months in the SA+F group (-.31 [95% CI -.07 to -.55]), whereas there were increases in the SA group (.10 [95% CI -.27 to .47]) and the control group (.39 [95% CI .06 to .72]).

There were decreases in the number of binge drinking days from baseline to 3 months in the SA+F group (-.51 [95% confidence interval {CI} -.10 to -.95]), whereas there were increases in the SA group (.90 [95% CI .23 to 1.6]) and the control group (.41 [95% CI -.20 to 1.0]). (Table 2). The ZIP regression model predicting number of binge drinking days at 3-months indicated a significant difference among the 3 study conditions. Using listwise deletion, participants in SA+F had no reductions (IRR 0.91 (95% CI 0.82 to 1.02) in binge drinking days in the past 30 days at follow-up compared to control participants. Using

multiple imputation, participants in SA+F also showed no reductions (IRR 0.99 (95% CI 0.93 to 1.05) in binge drinking days in the past 30 days at follow-up compared to control participants.

There were greater reductions in the proportion of participants with any binge drinking in the last 30 days from baseline to 3 months in the SA+F group (-14.5% [95% CI -11% to -19%]) compared to the SA group (-3.1% [95% CI -1% to -7%]) and the control group (-2.0% [95% CI -1% to 6%]) (Table 3). For the model predicting no binge drinking in the last 30 days at 3-months, there was a significant difference among the 3 study conditions. Using listwise deletion, participants in SA+F were 2.4 (95% CI 1.39 to 4.14) times more likely to not report any binge drinking in the last 30 days at follow-up than the control participants. Using multiple imputation, participants in SA+F were 2.09 (95% CI 1.28 to 3.40) times more likely to not report any binge drinking in the last 30 days at follow-up than the control participants.

There were several covariates associated with binge drinking outcomes at 3-months. As may be expected, a higher number of binge drinking days at baseline was associated with a higher number of binge days at 3-months (IRR 1.09 [95% CI 1.08 to 1.10]) and lower odds of reporting no binge drinking days (OR 0.71 [95% CI 0.65 to 0.78]). Compared to whites, African Americans had fewer binge drinking days (IRR 0.85 [95% CI 0.77 to 0.95]) and were more likely to report having no binge drinking days (OR 2.42 [95% CI 1.53 to 3.82]) at follow-up. Those enrolled in college were less likely to report no binge drinking days at follow-up compared to those not in college (OR=0.48 [95% CI 0.30 to 0.76]).

Web-Based TLFB Drinks per Drinking Day

There were also decreases in the number of drinks per drinking day from baseline to 3 months in the SA+F group (from 3.8 [95%CI 3.6 to 4.0] to 3.5 [95% CI 3.3 to 3.7]), whereas there were increases in the SA group (from 4.0 [95% CI 3.6 to 4.4] to 4.2 [95% CI 3.8 to 4.6]) and the control group (from 3.6 [95% CI 3.3 to 3.9] to 4.0 [95% CI 3.6 to 4.4]). (Table 2). For the model predicting number of drinks per drinking day, there was a significant difference across the 3 study conditions. Using listwise deletion, participants in SA+F had fewer drinks per drinking day at 3-months than control (IRR 0.86 [95% CI 0.79 to 0.94]). Using multiple imputation, the reductions in drinks per drinking day became non-significant (IRR 0.91 [95% CI 0.79 to 1.05]).

SMS-Based Weekend Binge Drinking & Max Drinks

On average, there were fewer SA+F participants reporting a weekend binge over 12 weeks (30.5% [95% CI 25% to 36%) compared to the SA participants (47.7% [95% CI 40% to 56%]). The differences reached statistical significance by week 3, and remained different through week 12, as shown in Figure 3. There were also less drinks consumed per weekend in the SA+F group over 12 weeks (3.2 [95%CI 2.6 to 3.7]) compared to the SA group (4.8 [95% CI 4.0 to 5.6]). The differences reached statistical significance by week 3, and remained different through week 12, as shown in Figure 4.

Limitations

A limitation of this study is that it is not possible for participants to be blinded to the intervention condition. We attempted to minimize this effect by concealing condition allocation from participants in the ED. Findings may not generalize to patient groups not included in this single-city study, such as young adults presenting with a history of treatment for drugs or psychiatric disease or those who present to the ED with an alcohol-related visit. The self-report data are a potential limitation; however, reviews support the reliability and validity of self-report of risk behaviors when privacy/confidentiality is ensured[36] and when using self-administered computerized assessments[37]. Our use of weekly (weekend) SMS in addition to web-based 30-day recall for recording self-reported drinking outcomes makes the possibility of reporting bias less likely.

The follow-up rate of 78% at 3-months and differential loss-to-follow-up among heavier drinkers may introduce attrition bias. We note, however, that less than half of all published ED-based brief intervention studies for alcohol achieve 80% follow-up, with dropout rates as high as 40% at comparable follow-up time periods.[9] Further, we included relevant covariates in our primary analyses and performed sensitivity analyses using imputation procedures to help mitigate possible effects of attrition. When imputation for loss to follow-up and missing data was performed, the reduction in binge drinking days and drinks per drinking day became non-significant. We did not examine alcohol-related harm (i.e. drunk driving) as an outcome, given that our intervention did not directly attempt to modify alcohol-related risk behavior. Finally, we did not examine the potential degradation of effects over time.

Discussion

A text message intervention for young adults who screened positive for hazardous drinking produced small reductions in binge drinking and the drinks consumed per drinking episode up to 3-months after ED discharge. These results were consistent across outcomes measured through web-based calendar recall and weekly SMS reports, but were smaller than those found in our pilot trial, and vulnerable to attrition bias.

There are few ED-based studies that have examined effects of interventions targeting young adults[40]. In 2008, Monti et al.[41], demonstrated that an in-person motivational interview with 87 young adults who present with a positive blood alcohol content can result in alcohol consumption reductions at 6-months post ED discharge. In 2012, D'Onofrio et al.[42] showed that a brief negotiated interview with hazardous drinkers can reduce alcohol consumption at 6- and 12-months post ED discharge, but that these effects were not significant in young adults. The effect size of the text message intervention on binge drinking (Cohen's d= 0.22; 95% CI .02 to .42) was smaller than those found in a meta-analysis of in-person brief interventions for alcohol consumption at ≤3 months (Cohen's d=.67; 95% CI 0.39 to 0.95)[38], but comparable to those found in a meta-analysis of interventions to reduce binge drinking among first-year college students (Cohen's d=.13; 95% CI .05 to .21)[39]. Although the effect sizes of the text message program are relatively small, achieving even modest reductions

among a large group of drinkers could result in greater gains relative to more expensive efforts among a smaller number of drinkers[43].

Still, we recognize that the SMS intervention may not be optimized. Although the participation rates were fairly high, and comparable to other SMS intervention[44, 45], they decreased significantly over 12 weeks. Future mobile interventions may need to incorporate additional components to keep young adults engaged at higher rates. To improve efficacy, future SMS interventions may need to incorporate other behavioral techniques found to be useful for alcohol prevention and/or provide them with greater intensity or longer periods. Finally, given that 50% of enrolled young adults had used cannabis in the past 3 months suggests that SMS interventions may need to address multiple drug use.

We did not show a significant reduction in drinking variables in the non-intervention groups (SA, control) from baseline to 3-month follow-up. This finding is contrary to prior research showing that drinking assessments alone can result in reductions in drinking behavior[29], but consistent with our pilot trial[22]. For the control condition, this suggests that the self-awareness of being a hazardous drinker and being asked to report alcohol use at baseline does reduce alcohol use. For the SA condition, this supports prior ecological momentary assessment research suggesting that awareness of behavior alone may not result in significant “assessment reactivity” or behavior change[46]. Our observation of potential increases in alcohol use in the control conditions is consistent with the natural developmental escalation of alcohol use for some drinkers in this age range[47].

We identified some patient characteristics that were associated with 3-month binge drinking outcome. For example, similar to prior studies[48,49], greater baseline alcohol severity was associated with worse outcome. Being African American was associated with better binge drinking outcomes at 3-months than being white. This finding warrants further study of race being a possible moderator of intervention effects on alcohol outcomes.

In summary, although a replication that includes longer follow-up is required, findings of this large RCT support the short-term efficacy of a text message intervention in producing small reductions in binge drinking and alcohol consumption among young adult hazardous drinkers. Text message approaches could be integrated into current SBIRT for young adults, with potential applicability across other risk behaviors (e.g., drug use, unprotected sex, interpersonal violence).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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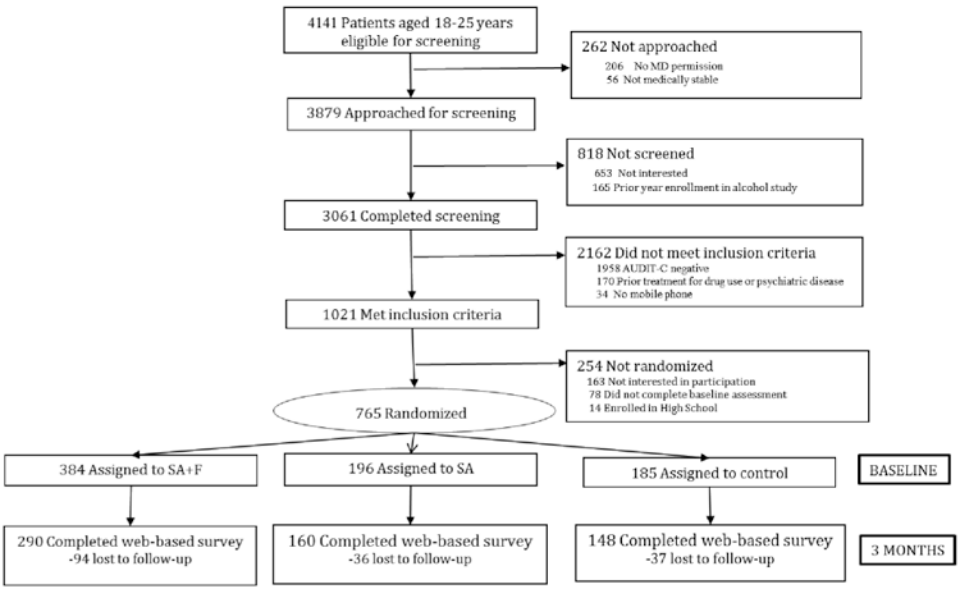

Figure 1. CONSORT diagram of patient screening and recruitment

Abbreviation: MD, medical doctor (Emergency Attending physician); AUDIT-C, Alcohol Use Disorders Identification Test-Consumption; SA+F, SMS Assessments with Feedback; SA, SMS Assessments without Feedback.

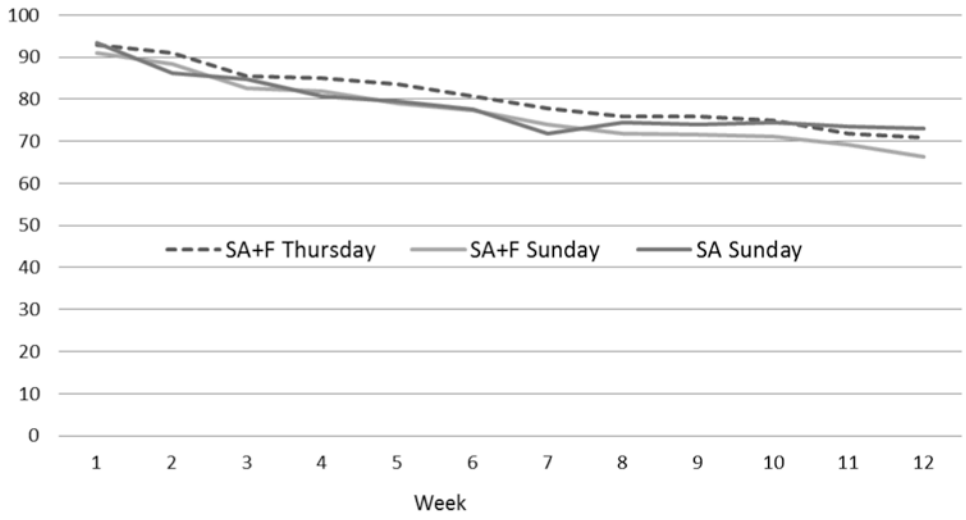

Figure 2. Percentage of Participants Responding to SMS Queries

Abbreviation: SA+F, SMS Assessments with Feedback; SA, SMS Assessments without Feedback.

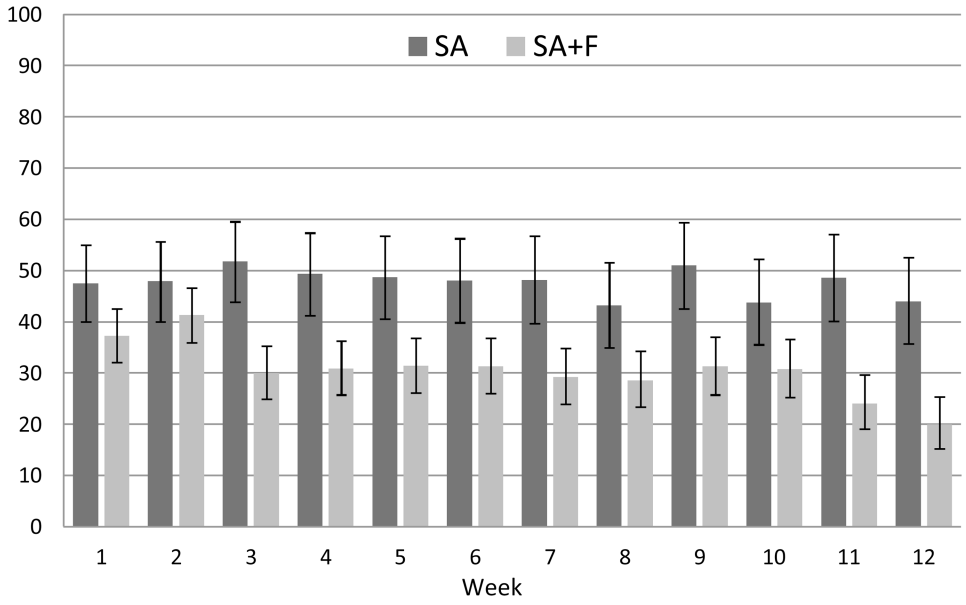

Figure 3. Percentage of Participants Reporting Weekend Binge Drinking through SMS

Abbreviation: SA+F, SMS Assessments with Feedback; SA, SMS Assessments without Feedback. Error bars represent 95% confidence intervals.

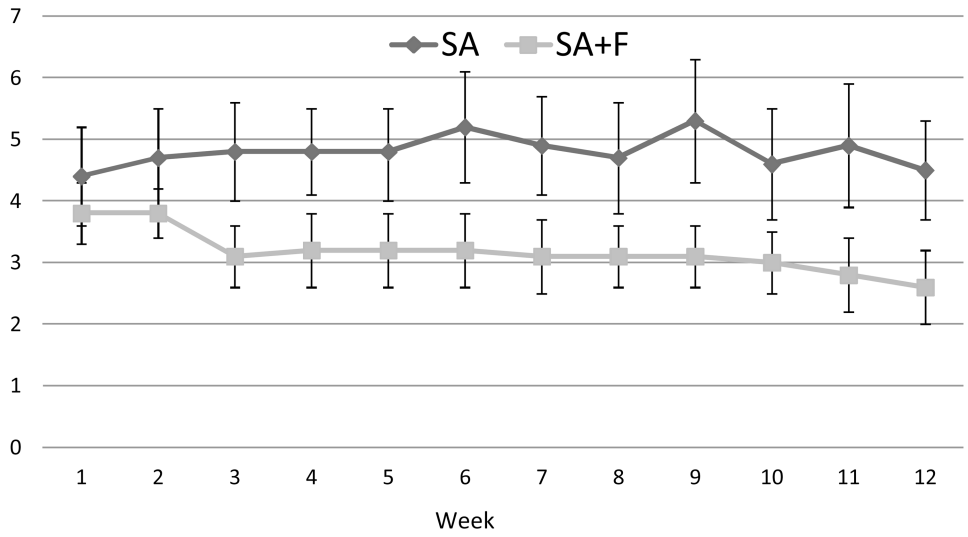

Figure 4. Maximum Drinks Consumed per Weekend reported through SMS

Abbreviation: SA+F, SMS Assessments with Feedback; SA, SMS Assessments without Feedback. Error bars represent 95% confidence intervals of mean drinks.

Table 1

Baseline Characteristics

Characteristics	SA+F (n=384)	SA (n=196)	Control (n=185)
Age, mean (SD), y	22.0 (2.0)	22.0 (2.0)	21.8 (2.1)
Female	251 (65.4)	125 (63.8)	124 (67.0)
Race			
African American	158 (41.2)	88 (44.9)	83 (44.9)
White	190 (49.5)	98 (50.0)	88 (47.6)
Other	36 (9.4)	10 (5.1)	14 (7.6)
Hispanic Ethnicity	22 (5.7)	10 (5.1)	15 (8.1)
Current College enrollment	162 (42.2)	85 (43.4)	87 (47.0)
Living arrangements			
Live alone	88 (22.9)	41 (20.9)	29 (15.7)
Friends, same sex	116 (30.2)	44 (22.4)	49 (26.5)
Friends, other sex	42 (10.9)	29 (14.8)	22 (11.9)
Parents or family	138 (35.9)	82 (41.8)	85 (46.0)
Employment			
None	120 (31.2)	62 (31.6)	61 (33.0)
Part-time	110 (28.7)	59 (30.1)	62 (33.5)
Full-time	154 (40.1)	75 (38.3)	62 (33.5)
AUDIT-C score, mean (SD)	6.3 (2.2)	6.3 (2.2)	6.2 (2.1)
Other Substance Use last 3 months			
Daily or almost daily tobacco	145 (37.8)	72 (36.7)	64 (34.6)
Any cannabis	197 (51.3)	94 (50.0)	95 (51.4)
ED Chief Complaint			
Minor trauma/ Musculoskeletal	88 (22.9)	43 (21.9)	38 (20.5)
Neuro/Syncope	18 (4.7)	9 (4.6)	14 (7.6)
Abdominal pain/ Urogenital	96 (25.0)	43 (21.9)	54 (29.2)
Eye/ENT/Dental	29 (7.6)	11 (5.6)	11 (6.0)
Cardiac/ Respiratory	20 (5.2)	17 (8.7)	14 (7.6)
Other	133 (34.6)	73 (37.2)	53 (29.2)
ED Visit Due to Alcohol	12 (3.1)	3 (1.5)	4 (2.2)

Abbreviation: SA+F, SMS Assessments with Feedback; SA, SMS Assessments without Feedback; AUDIT-C, Alcohol Use Disorders Identification Test-Consumption; ENT, Ear, Nose & Throat. Data are expressed as No. (%) unless otherwise indicated.

Table 2

Changes in Mean Binge Drinking Days and Drinks per Drinking Day; Baseline to 3-Month Follow-up

		Baseline		3-Months		Change	
		mean	95% CI	mean	95% CI	mean	95% CI
No. binge drinking days							
	SA+F	3.7	3.2, 4.2	3.1	2.6, 3.6	-.51	-.95, -.10
	SA	3.3	2.6, 4.0	4.2	3.3, 5.1	.90	.23, 1.6
	Control	3.2	2.6, 3.8	3.6	2.9, 4.3	.41	-.20, 1.0
No. drinks per drinking day							
	SA+F	3.8	3.6, 4.0	3.5	3.3, 3.7	-.31	-.55, -.07
	SA	4.0	3.6, 4.4	4.2	3.8, 4.6	.10	-.27, .47
	Control	3.6	3.3, 3.9	4.0	3.6, 4.4	.39	.06, .72

Abbreviation SA+F, SMS Assessments with Feedback; SA, SMS Assessments without Feedback; No., number; 95% CI, 95% confidence interval.

Table 3

Changes in Percent of Participants Reporting Any Binge Drinking; Baseline to 3-Month Follow-up

		Baseline		3-Months		Change	
		%	95% CI	%	95% CI	%	95% CI
Participants with any binge drinking day	**SA+F**	79.3	.74, .84	64.8	.59, .70	14.5	.11, .19
	SA	78.1	.78, .81	75.0	.68, .81	3.1	.01, .07
	Control	79.7	.72, .86	77.7	.70, .84	2.0	.01, .06

Abbreviation SA+F, SMS Assessments with Feedback; SA, SMS Assessments without Feedback; No., number; 95% CI, 95% confidence interval.