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A Brief Motivational Interview in a Pediatric Emergency Department, Plus 10-Day Telephone Follow-Up, Increases Attempts to Quit Drinking Among Youth and Young Adults Who Screen Positive for Problematic Drinking

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Abstract

Objectives—Adolescents in their late teens and early twenties have the highest alcohol consumption in the United States; binge drinking peaks at age 21 years. Underage drinking is associated with many negative consequences, including academic problems and risk of intentional and unintentional injuries. This study tested the effectiveness of pediatric emergency department (PED) screening and brief intervention to reduce alcohol consumption and associated risks.

Methods—A three-group randomized assignment trial was structured to test differences between intervention (I) and standard assessed control (AC) groups in alcohol consumption and alcohol-related behaviors from baseline to 12 months, and to compare the AC group with a minimally assessed control group (MAC) to adjust for the effect of assessment reactivity on control group behavior. Patients aged 14–21 years were eligible if they screened positive on the Alcohol Use Disorders Identification Test (AUDIT), or for binge drinking or high-risk behaviors. The MAC group received a resource handout, written advice about alcohol-related risks, and a 12-month follow-up appointment. Patients in the AC group were assessed using standardized instruments in addition to the MAC protocol. The intervention group received a peer-conducted motivational intervention, referral to community resources and treatment if indicated, and a ten-day booster in addition to assessment. Measurements included 30 day self-report of alcohol consumption and alcohol-related behaviors, screens for depression and posttraumatic stress disorder, and self-report of attempts to quit, cut back, or change conditions of use, all repeated at follow-up. Motor vehicle records and medical records were also analyzed for changes from baseline to one year follow-up.

Results—Among 7,807 PED patients screened, 1,202 were eligible; 853 enrolled (I n = 283; AC n = 284; MAC n = 286), with a 12-month follow-up rate of 72%. At 12 months, more than half of enrollees in RAP (Reaching Adolescents for Prevention) attempted to cut back on drinking, and over a third tried to quit. A significantly larger proportion of the I group made efforts to quit drinking and to be careful about situations when drinking compared to AC enrollees, and there was a numerically but not significantly greater likelihood ($p = 0.065$) among the I group for efforts to cut back on drinking. At three months, the likelihood of the I group making attempts to cut back

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was almost triple that of ACs. For efforts to quit, it was double, and for trying to be careful about situations when drinking, there was a 72% increase in the odds ratio for the I group. Three-month results for attempts were sustained at 12 months for quit attempts and efforts to be careful. Consumption declined in both groups from baseline to 3 months to 12 months, but there were no significant between-group differences in alcohol-related consequences at 12 months, or in alcohol-related risk behaviors. We found a pattern suggestive of assessment reactivity in only one variable at 12 months: the attempt to cut back (73.3% for the I group vs. 64.9% among the AC group, and 54.8% among the MAC group).

Conclusions—Brief motivational intervention resulted in significant efforts to change behavior (quit drinking and be careful about situations while drinking) but did not alter between-group consumption or consequences.

Keywords

youth drinking; brief intervention; SBIRT; motivational interviewing; alcohol consequences

INTRODUCTION

Adolescents in their late teens and early twenties have the highest alcohol consumption in the United States,¹ and binge drinking peaks at age 21.² Underage drinking is associated with academic and social problems, physical and sexual assault, memory problems, increased risk of suicide and homicide, car crashes, intentional and unintentional injuries, and death from alcohol poisoning.³ Among 15 to 29 year olds, high-risk alcohol use is implicated in 86% of the 3.6 million substance abuse associated deaths reported worldwide.⁴ Many types of preventive interventions for youth and young adults are in use, but few have been rigorously tested.⁵

The motivational interviewing strategies that have been studied and found to be useful for early intervention and secondary prevention among adults may have application for adolescents. Meta-analyses by Bertholet et al.,⁶ Vasilaki et al.,⁷ and Hettema et al.⁸ have demonstrated reductions in consumption among adults in primary care settings, with the strongest effects seen at three months. In the emergency department (ED) environment, brief intervention has been recommended,⁹ but results of ED-based brief intervention among adults have been more mixed, with five negative result studies reported among the 14 included in a recent meta-analysis.¹⁰ A meta-analysis by Havard et al. showed that brief intervention decreases the probability of re-injury, but not of alcohol consumption.¹¹ Daeppen, commenting on these findings, suggests that investigation of the differential influence of factors related to patient, counselor, intervention, setting, and research methodology is needed before we can reach consensus about the effectiveness of brief alcohol interventions in the ED setting.¹²

Among adolescents, motivational interventions to reduce alcohol consumption and alcohol associated risk behaviors have had generally favorable results, but the body of work in adolescents is not as well-developed as it is in adults. In the college population, motivational interviewing has been shown to be particularly successful,^{13–14} and web-based interventions are promising.^{15–17} In one study of the effects of normative feedback among high-risk youth in the workplace, in-person and web-delivered formats were found to be equally effective,¹⁸ and a pilot project in a community based primary care setting identified motivational intervention as feasible.¹⁹ Two randomized, controlled trials reported among ED patients have shown positive but very different results. One showed an effect on alcohol-related consequences at six months follow-up, but not on alcohol consumption.²⁰ The other, which included 20–30 minute telephone booster contacts at 1 and 3 months, demonstrated a

reduction in consumption at 6 and 12 months, but no differences in the reduction in alcohol-related problems, compared to a control group that received feedback only.²¹

The purpose of this research study was to test the effectiveness of a brief motivational intervention, compared to two different control groups (one minimally assessed and one fully assessed) on various measures evaluating the consumption of alcohol, the intent to change consumption of alcohol, and certain adverse consequences of alcohol consumption by a diverse sample of inner city adolescent ED patients who screened positive for high-risk or dependent drinking. This design inherently permits an evaluation of the degree of response that is related to “assessment reactivity,” as suggested in the 2009 *Academic Emergency Medicine* consensus conference, “Public Health in the Emergency Department: Surveillance, Screening, and Intervention.” Assessment reactivity refers to the observation that research assessment instruments may trigger control group enrollees’ awareness of risky drinking (the process goal of intervention) and self-monitoring (the outcome goal of intervention).

METHODS

Study Design

Project Reaching Adolescents for Prevention (RAP) was a prospective, three group randomized assignment trial of screening and brief intervention (SBI) for youth and young adults aged 14–21 years presenting to the pediatric emergency department (PED) from April, 2004 to March, 2009. Randomization of each subject was to one of three groups [intervention (I), standard assessed control (AC), and minimally assessed control (MAC)], in order to test the feasibility of identifying potential assessment reactivity effects. The study was approved by the Boston University Medical Center (BUMC) Institutional Review Board. Written informed consent was obtained from all subjects, and the study received a certificate of confidentiality at both federal and state levels. The study was monitored yearly by a Data Safety Monitoring Board. Patients less than 18 years of age were allowed to assent with parent opt-out (participate without written consent of a parent unless parents notified investigators of objections to their child’s enrollment).

Study Setting and Population

The study took place in the PED of BUMC, an inner-city, academic hospital. The PED is a component of a Level I trauma center, and has a yearly census of approximately 29,000 patients from birth through the 21st birthday. Of these, 8,000 are between the ages of 18–21 years. The patient population is 60% female, and ethnically and culturally diverse: 46% African American, 19% Hispanic, 19% white, 6% Haitian, 7% Cape Verdean, and 3% Asian. Four-fifths speak English at home.

Patients presenting during the hours of screening were invited to participate in the study if they: 1) reported binge drinking, (five or more drinks in two hours for males and four or more for females); and/or high-risk behaviors in conjunction with alcohol use (unplanned or unprotected sex, driving or riding with a drunk driver, injury, fighting, a car crash, or an arrest); and/or an AUDIT score of ≥ 4 for ages 14–17 years, or ≥ 8 for ages 18–21 years. Eligibility was thus designed to include the range of high risk to dependent drinkers, in order to focus on both early intervention and timely secondary prevention. This study, unlike those of Monti and colleagues,²⁰ admitted “all comers” (the non-injured and non-intoxicated patients).

Patients were included in the study if they could communicate in English, Spanish, Haitian Creole, or Cape Verdean Creole; were alert and oriented to person, time, and place; and could give autonomous informed consent (or assent if they were below the age of 18).

Patients were excluded if they 1) could not be interviewed in privacy from accompanying family members, 2) planned to leave the area in the next three months, 3) could not provide reliable contact information to complete the follow-up procedures, 4) were currently in a residential substance abuse treatment facility, 5) were in custody or institutionalized; 6) presented for a rape exam or psychiatric evaluation for suicide precautions, or 7) if parents opted out for patients younger than age 18. Eligible patients were asked to repeat and explain the key elements of the study prior to signing informed consent, and their responses were documented on a checklist.

Study Protocol

Pediatric ED patients aged 14–21 years old who gave verbal consent were screened seven days per week from 8am–10pm in the privacy of either a room adjacent to the waiting room or in the examining room. Patients under the age of 18 years whose parents were not present were eligible for screening, and all patients were approached unless clinicians indicated that they were medically unstable.

The screening instrument, the “Youth and Young Adult Health and Safety Needs Survey,” included risk questions from the CDC Youth Risk Behavior Survey (YRBS). Patients who responded that they had used alcohol in the last 30 days were asked to complete the adolescent and young adult version of the Alcohol Use Disorders Identification Test (the AUDIT). This inventory has a fairly high negative predictive value for alcohol-related problems, but a lower positive predictive value, because its sensitivity 94% and its specificity is 80% for this study’s age group.²²

Randomization—Enrollees were randomized to three conditions: I, AC, and MAC. Minimal assessment consisted of the screening survey only; standard assessment, the battery of instruments described below, was administered to the I and AC groups. Randomization was based on computer-generated lists, blocked to balance assignment after every nine subjects and stratified by age group (14 – 17 years and 18 – 21 years).

The research assistants who performed the assessment were blinded to randomization status through two-stage assignment using a double opaque envelope system. The first envelope, opened immediately after enrollment, indicated randomization to either minimal assessment (MAC) or assessed status (I or AC). If the card stated ‘assessment’ the participant completed the standard assessment battery. Immediately after assessment, a second sealed envelope, contained within the original randomization envelope, was then opened to distinguish between assessed controls and those participants eligible for an intervention (AC vs. I). Participants were cautioned not to discuss their enrollment procedures or status with the research assistants who conducted their follow-ups.

Procedures—The MAC received only a brief written hand-out containing advice about risks associated with alcohol use, along with a list of community resources and adolescent treatment facilities, and an appointment for follow-up in one year. The AC group received a battery of standard assessment instruments (see Data Supplements 1–8, available with the online version of this article), a brief written alcohol-use risk handout, and appointments to return for re-assessment after three months, and after one year. In addition to the assessment, the I group received a 20–30 minute structured conversation delivered by a peer educator, plus a “booster” telephone call at 10 days post-enrollment from the same person who had delivered the intervention. During the “booster” call, the peer educator reminded enrollees about the referrals they had received at the time of the intervention (either to youth oriented services or to treatment), asked enrollees whether they had attempted to complete these referrals, and had a brief conversation about any barriers they had encountered in making the

changes agreed to in the original intervention. Interventionists then reinforced positive attempts to change and made additional referrals if requested.

Assessment Instruments

Measures designed to assess outcomes: The Timeline FollowBack (TLFB) calendar (DS 1) was used to obtain reliable and valid self-report data on number of drinks per day, mean number of drinking days per month, and maximum drinks per drinking occasion.²³ The I and AC groups reported 30-day alcohol consumption by TLFB at baseline and again at three and 12 months; the MAC group reported alcohol consumption by TLFB at 12 months only. The TLFB uses calendars, holidays, and special events to trigger memory, and is reported to reduce error in retrospective self-report; validity and reliability for recall of alcohol use have been well established.^{24,25}

The 17-item *Adolescent Injury Checklist* (AIC) (DS 2) was conducted at baseline for the I and AC groups. The AIC has an internal consistency of $\alpha = 0.67$ for injury occurrence and $\alpha = 0.62$ for injury requiring medical care.²⁶

The *Drinking and Driving scale* 27 (DS 3) includes the following items: the number of times the person drove high or light-headed, an hour after 1–2 drinks, after 3+ drinks, when coordination was affected, and while drunk. An internal consistency of $\alpha = 0.89$ is reported for this scale.

The 14-item alcohol section of the *Adolescent Health Behavior Questionnaire* (AHBQ) 28 (DS 4), developed by Jessor et al., uses a Likert scale format (1–5) to assess trouble experienced over six months as a result of events associated with alcohol. The scale has an internal consistency of $\alpha = 0.83$ and a goodness of fit (internal validity) of 0.982 to 0.999.²⁸

Measures administered to assess comparability of randomization groups: Several instruments were used at baseline to measure variables that have been shown to moderate risks associated with substance abuse, e.g. depression, global risk-taking personality propensity, and prior exposure to violence associated with post traumatic stress disorder (PTSD) symptoms.

The *Patient Health Questionnaire* (adolescent version) or PHQ-A depression scale (DS 5) is a 15-item self-report questionnaire designed for the purpose of assessing mood disorders among adolescents seen in primary care clinics. This scale has good concurrent validity testing against DSM-IV diagnoses.²⁹ The Simpson and Joe *Risk-taking Scale* (DS 6), conducted at baseline for I and AC groups, has been shown to be a strong predictor of self-reported drug use. This scale has an acceptable test-retest reliability, and good psychometric properties (internal consistency of $\alpha = 0.77$ and goodness of fit index of 0.97).³⁰

The *PTSD Checklist Civilian version* (PCL-C) (DS 7) is a 17-item inventory that assesses the specific symptoms that make up the PTSD diagnosis. Test-retest reliability is excellent at 0.96 and diagnostic efficiency is 0.90.³¹

Intervention—Interventions were delivered by peer educators who were under 25 years of age and spoke Spanish, Haitian Creole, and Cape Verdean as well as English; all except one had bachelor's degrees. The peer educators each received one month of training that began with educational slide presentations regarding protection of human subjects, the study protocol, key features of adolescent development, the rationale for the interventions assessed, elements of motivational interviewing style, and training in potential threats to validity. The intervention algorithm was taught using video demonstrations, role playing

with simulated patients, and adherence scoring of video and audio tapes of practice interviews.

The intervention format, successfully tested with adults in a cocaine and heroin study,³² was adapted to incorporate both developmental and contextual aspects of young people's lives, and included an emphasis on assessing and enhancing sources of resilience (individual sources of strength and support related to adolescents ability to recover from stressful events).³³ The intervention content, based on research by Holland and Miller,³⁴ Miller and Rollnick,³⁵ and Monti et al.,^{20–21} consisted of the following components: 1) obtaining engagement and permission to raise the subject; 2) establishing context ("What's a typical day in your life like?"); 3) offering brief feedback, information, and norms, specific to age and sex, exploring pros and cons of the consumption of mind-altering substances while eliciting 'change talk,' and using the *CRAFT*³⁶ (DS 8) questions and a *Readiness to Change* ruler to reinforce movement toward behavior change; 4) generating a menu of options; 5) calling up assets and instilling hope; 6) discussing the challenges of change; and ending in a 7) prescription for change generated by the subject, and referrals to community resources and specialty drug treatment services. Patients with *CRAFT* scores of ≥ 2 were advised of need for further evaluation and treatment. Intervention patients received a five to ten minute "booster" phone call during which the interventionist reviewed the elements of the change plan, inquired about any progress towards change, and offered further referrals if those originally provided had not been possible to accomplish.

Adherence to the intervention algorithm was assessed weekly by the investigators and the project coordinator, and interventions were taped when permission was granted in a separate consent process. Randomly selected intervention tapes were discussed weekly by multiple raters in a consensus process using an adherence checklist of the key elements of the intervention (see DS 9); the criterion for acceptability was set at a mean score of $\geq 80\%$. Inter-rater reliability was not tracked. The process used for the initial training—interventionist self-scoring and description of strengths, challenges, and areas for improvement, followed by group discussion—was continued throughout the study for quality assurance.

Follow-up Procedures—Follow-up occurred at three and twelve months for the I and AC groups, and at 12 months only for the MAC group. Participants received \$10 at enrollment and \$35 at subsequent follow-up visits. To minimize attrition, participants received written and telephone reminders, including e-mail and text messages, at intervals prior to appointments, using standard methods for contacting friends, family members, caseworkers, and agencies.^{37,38}

Definitions—Abstinence was defined as zero alcohol consumption in the last 30 days, as recorded on the TFLB. Use was defined by number of drinking days, number of drinks per typical drinking day, and number of binge episodes per month. Binge was defined as greater than five drinks per occasion for males and greater than four drinks per occasion for females.

Outcome Measures

Primary outcomes included: abstinence at 12 months, and changes in patterns of alcohol use measured by TLFB; intention to quit using, cut back on use, or change the circumstances of use; and reduction of consequences such as alcohol-related injury, driving under the influence, and high-risk behaviors related to alcohol use such as fights, unprotected or unplanned sex, or accepting a ride from a drinking driver.

Data Analysis

Power considerations—We targeted an enrollment sample of $n = 810$, with $n = 270$ participants per group, and an anticipated 75% follow-up at 12 months, to provide 80% power of detecting a reduction in alcohol consumption in the I group, compared to the AC group, corresponding to an effect size of $d = 0.28$ (where d is the difference in mean reduction between the I and AC groups divided by the standard deviation [$\pm SD$]). This anticipated effect size was based on reported intervention effects on alcohol consumption of two studies of brief intervention with adolescents.^{20,21}

Data sources—Four data sources were included in this analysis: 1) enrollee self-report at baseline, three, and 12 months follow-up; 2) an administrative data set representing institutional health care services received by enrollees in the year prior to and the year post-enrollment; 3) a state Registry of Motor Vehicles data set listing violations and incidents for the same period; and 4) a Department of Public Health treatment data set representing services provided in 90% of inpatient facilities state-wide.

Outcomes analysis—We compared baseline risk assessment variables between I and AC groups using chi-square. We compared attempts to change drinking behavior at 12 months between I and AC groups for the entire population and by subgroups (AUDIT score, PCL-C result, age), testing for differences with chi-square. We used generalized estimating equation (GEE) logistic regressions to present adjusted odds ratios that measure responses to categorical variables. In these analyses, an odds ratio of >1 indicates that the I group was more likely to respond “yes” than the AC group; an odds ratio of <1 indicates that the I group was less likely to respond “yes” than the AC group. The interaction p-value tests whether the odds ratio describing intervention effects at three months was different from the intervention effects odds ratio at 12 months (i.e., whether the intervention effect changes over time), and the main effect p-value tests whether a difference existed between I and AC groups across both time points.

For continuous measures, we used mixed effect linear regression models. First we present adjusted least squares means at baseline, three months, and twelve months by I and AC group. The interaction p-value tests whether the difference in intervention means changed from baseline to three months or 12 months (i.e., whether the intervention effect changes over time), and the main effects p-value tests whether there was a difference between groups across all three time points. Next, we adjusted for baseline. The interaction p-value tests whether the difference in adjusted means between intervention groups changed from three to 12 months, and the main effects p-value tests whether there was a difference between groups across the two time points.

RESULTS

Among 9,521 patients approached for screening, 1,714 refused (18%). Primary reasons given included “don’t feel well” and “not interested.” Among a convenience sample of 7,807 PED patients screened, 1,202 met eligibility criteria. Among those, 6,260 were excluded for lack of risk factors, 23 because they were already in treatment, 7 because of clinical severity, and 315 for administrative reasons (lack of privacy to enroll, plans to leave the area, or no reliable contact information), representing an exclusion rate of 22%. (See Consort Diagram, Figure 1) Among eligible individuals, 853 (71%) were enrolled and randomized (I, $n = 283$; AC, $n = 284$; MAC, $n = 286$). Seventy percent completed the three month follow-up, and 72% completed the 12-month follow-up.

Those who did not enroll were more likely to be male (52.1% vs. 45.5%, $p = 0.032$), white (35.6% vs. 25.6%, $p = 0.004$), and currently attending school (86.5% vs. 74.7%, $p = 0.013$)

than the enrolled group, and less likely to have had previous therapy for a psychological disorder (24.2% vs. 38.7%, $p = 0.006$). There were no significant differences between enrollees and refusers in age of drinking onset, AUDIT scores, previous arrest records, or heavy marijuana use (data available from author on request). At the time of initial assessment, 25% of enrollees reported that they were employed. Educational experience was diverse: 21% were currently in high school, 57% had graduated or completed a GED, and 22% had dropped out of high school; among those who had graduated from high school, 55% were attending college either full or part time.

Comparability of randomization groups at baseline

Among the three randomization groups, there were no significant differences at baseline in age, sex, race, or primary language. Baseline characteristics of I and AC groups are reported in Table 1.

The three groups were also similar in baseline AUDIT score by age group, and in consumption variables drawn from survey responses (Table 2). Groups were also similar in alcohol-associated risk factors reported on the screening survey, with one exception: the AC group had a higher rate in the relatively rare event of driving after drinking ($n = 45$, 15.9%) than either the I ($n = 25$, 8.9%), or the MAC ($n = 23$, 8.1%) groups ($p < 0.05$). Among the I and AC groups, there were no significant differences in baseline scores for PTSD, depression, risk-taking, or alcohol-related injury (Table 3), but I was greater than AC ($p = 0.017$) in the proportion who scored high on the peer pressure variable from the Jessor AHBQ scale (“friends strongly approve of drinking or pressure to drink more than now”) (see Table 3).

Intervention effects at 12 months post enrollment—All scored adherence checklists (80% of intervention tapes) met the required cut-off of 80 out of 100 points. Among high-risk drinkers, I group patients were significantly more likely than AC enrollees to remember receiving a referral to a community youth program as part of their enrollment visit (21.5% vs. 5.9%, $p = 0.001$), suggesting that interventionists performed referrals as dictated by protocol.

Attempts to quit, cut back and/or change drinking behaviors (Table 4)

More than half of all enrollees attempted to cut back on drinking, and more than a third tried to quit. Certain patterns of intervention effects differed by AUDIT and PTSD scores, and by age group. Among all enrollees, a significantly larger proportion of the I group made efforts to quit drinking and to be careful about situations when drinking, compared to AC enrollees. There existed a numerically greater but not statistically significantly greater likelihood among the I group for efforts to cut back on drinking ($p = 0.065$).

Patterns of attempted change among enrollees with low AUDIT scores (those at or below the cutpoint for hazardous drinking) differed from patterns found among those with AUDIT scores exceeding the cut point for risk. Outcomes were similar for I and AC among those with high scores, but among those in the low risk group, intervention recipients were more likely to attempt to cut back and/or try to quit drinking.

Participants in this study were assessed for PTSD positivity primarily to assure comparability of groups at baseline. Because prevalence was high and similar between the two groups, we performed a sub-analysis to evaluate potential differences in intervention effectiveness among those who were positive on the PCL-C scale. Among those who were negative on the PCL-C scale, the I group was more likely than the AC group to try to cut back and/or be careful about situations when drinking; however there was no difference in

attempts to quit drinking between the two groups. Among those who were positive for PTSD via the PCL-C, the pattern was reversed; groups were similar for cutting back and being careful, but a significantly higher proportion of the I group reported attempts to quit drinking.

Patterns of attempt also appeared to differ by age. Among 18–21 year olds, the I group was more likely than the AC group to report attempts in all three domains (cutting back, quitting, and being careful). In the younger age group, however, there were no differences between groups in any of the three dimensions of change effort that we measured.

A generalized estimating equation (GEE) model was used to assess changes over time as well as main effects (see Table 5). At three months, the likelihood of the intervention group making attempts to cut back was almost triple that of assessed controls. For efforts to quit, it was double, and for trying to be careful about situations when drinking, there was a 72% increase in the odds ratio for the intervention group. At 12 months an interaction effect existed for attempts to cut back; the likelihood dropped to 48% and was no longer significant, but three-month results were sustained at 12 months for quit attempts and efforts to be careful.

Consumption and risk factors

We used an unadjusted mixed effects linear regression model to analyze trends in consumption variables (Table 6). Mean values for all four estimates of alcohol consumption declined in both groups from baseline to 3- months to 12-months. The decline was numerically greater in the intervention group, but high inter-subject variability existed, and the results did not approach statistical significance. Results were similar when we adjusted for baseline values (see Table 7), and there were no significant differences between groups in alcohol-related consequences at 12 months.

A sub-analysis showed that the numerical differences between I and AC groups were greater in the high-risk AUDIT group for maximum drinks per day (I mean at 12 months = 6.5, SD ± 4.5 , a decrease of 3.2 from baseline (BL) vs. AC mean at 12 months = 7.9, SD ± 4.5 , a difference of 1.8 from BL; $p = 0.11$) and in the PCL-C positive subgroup (I mean = 4.8, SD ± 4.2 vs. AC mean = 6.1, SD ± 4.2 ; $p = 0.287$), although these numerical differences were not statistically significant.

Data obtained from the Registry of Motor Vehicles showed no differences by randomization group, but there were only 18 crashes reported in the pre-period and 12 in the post-period for the entire sample; these numbers were too small for a statistically meaningful comparison of I and AC. Medical record review comparing inpatient admissions and outpatient visits (clinics and PED) from the pre-enrollment year to the post-enrollment year also failed to show between-group differences in alcohol-related admissions, in injury, or in sexually transmitted infection rates or in pregnancy rates. Again, however, these events were rare.

Entry into treatment

We matched enrollees to the state's database for entry into substance abuse treatment (including detox, residential facilities, and outpatient counseling). In the period prior to enrollment, there were 14 individuals who received any type of treatment from state funded sources for alcohol problems, and the post-enrollment period, there were 19. These small numbers precluded statistically valid pre-post group comparisons. State treatment records did not contain contacts with Alcoholics Anonymous (AA), so other types of contact with services that we were unable to analyze may have occurred.

Sensitivity Analysis—The I and the AC groups were similar in demographics and alcohol use at baseline. Because the attrition rate was considerable, although not unexpected in a diverse urban ED setting, a sensitivity analysis was performed for attempts to quit drinking, assuming the position that all subjects lost to follow-up would have failed attempts to quit drinking. In this worst case analysis, the percentage of enrollees who made attempts to quit drinking was greater for the intervention group (I 29.3% vs. AC 20.4%, $p = 0.015$).

Assessment reactivity—We compared the AC group to the MAC group to determine if the assessment process itself, holding all other variables constant through a careful randomization process, could have an effect on outcomes. We found a pattern that resembled a dose-response curve in only one variable at 12 months: the attempt to cut back. The percentage reporting efforts to cut back was 73.3% in the I group vs. 64.9% among the AC group (those who received an assessment battery only), and 54.8% among the MAC group (those who received neither intervention nor standard assessment battery). The p -value for comparison of the AC and MAC groups for this variable was 0.039. For all other variables measured, the AC and MAC groups had similar responses at 12 months post-enrollment (data not shown).

DISCUSSION

We selected motivational interviewing constructs for the RAP intervention, not only because of evidence of effect on outcomes in the trials by Marlatt et al.³⁹ and Monti et al.,^{20,21} but also because of *prima facie* compatibility with the developmental needs of adolescents for autonomy, their self-perceived invulnerability to consequences, and a stage-appropriate lack of ability to connect behaviors driven by impulse to the potential for negative outcomes.^{40–42} We posited that the likelihood of positive outcomes would be enhanced by specific intervention elements: delivery by peers, non-judgmental exploration of discrepancies between present and desired states (cognitive dissonance), self-identification of alcohol-related issues, and negotiation of a ‘prescription to change.’ Unlike the studies previously cited, we found a significant difference between the intervention and the assessed control groups for efforts to change (quit attempts), but not for actual reductions in consumption or high-risk behaviors, beyond the improvement common to all three groups over time. The study by Marlatt et al. took place among college students who were very different in demographic attributes and life experiences³⁹ from the inner-city enrollees in this study. It is reasonable to posit that sample characteristics may account in part for the difference in findings. In the studies by Monti et al., eligibility was limited to patients who had experienced alcohol-related injuries or alcohol intoxication, and the mean AUDIT score was higher (10.8 vs. 8.5 for the comparable age group in this study).^{20,21} In contrast to these studies, among the 18 to 21 year olds, half of our sample was below the AUDIT cutpoint of eight, and only 14.7% had AUDIT scores ≥ 16 . Severity of consequences of alcohol use, associated with a ‘teachable moment’, may have contributed to outcome effects detected by Monti et al., but not by the current RAP study.

Quit attempts are an important precondition for lasting change. As documented in the smoking cessation literature, multiple quit attempts precede successful cessation,⁴³ and only 7% of initial attempts are successful.⁴⁴ In the case of Project RAP, any explanation for the gap we observed between attempts to change behavior and lasting behavior change was also confounded by the complex and challenging lives led by adolescents who use the ED facilities at a major inner-city public hospital. There exist several useful models for considering alcohol misuse in the context of development. In particular, an analysis of risk and resilience factors using latent growth curve modeling techniques demonstrates that risk and consequences vary with developmental level, individual characteristics, and environmental exposures. In other words, susceptibility to peer pressure, exposure to peer

alcohol use and misuse, and personal alcohol misuse increase over time.⁴⁵ The interaction of previous problems and life circumstances with developmental transitions may also provide an explanation for the gap between efforts to change drinking behaviors and the actual consumption and consequences that enrollees reported at 12 months. This model suggests that during times of rapid developmental change, a characteristic of adolescence, pre-existing conditions would affect sensitivity to the risk of negative outcomes. In our sample, standardized instruments revealed baseline rates of clinical depression (13%) and post-traumatic stress disorder (31%) that were well above average. Moreover, 31% of enrollees reported at baseline that they had been arrested or placed under the care of the Department of Youth Services because of problem behavior that pre-existed the study. The intervention group also reported a higher level of peer pressure than controls at baseline; relationship with peers was treated as an element of the intervention, but may have needed additional attention. In the language of motivational interviewing, many of the enrollees may have been *ready* and *willing*, based on attempts to cut back or quit, but not *able* to alter consumption and risk-taking behaviors. EDs offer a unique setting for engaging adolescents and young adults about high-risk and dependent alcohol and drug use, especially in the context of a related visit, but ED interventions have limitations: EDs cannot be expected to change the environment, the opportunity structure, or the social norms that influence underage drinking.

At the May 2009 *Academic Emergency Medicine* consensus conference on public health, questions were raised about the effects of assessment reactivity on intervention effectiveness.⁴⁶ This study represents an important contribution to that discussion. We found that all groups (including the minimal assessment status) improved over time, suggesting an expected effect for regression to the mean, but there was only one variable (attempts to cut back) in which assessment may have been a contributing factor. Effect sizes are typically small in studies of motivational interviewing, and it is tempting to investigators to use the potential for assessment reactivity to explain findings. Our results suggest that responses to assessment are unlikely to have an effect on outcomes of a sufficient magnitude to obscure intervention effects. In addition to regression to the mean, and the intensity and frequency of monitoring assessments, many of which share elements in common with the intervention, there are other rationales for all groups improving in this and other studies. These explanations include: 1) the IRB requirement to explain the purpose of the study may trigger social desirability bias and a desire on the part of enrollees to give the researchers what they think the study is designed to find; and 2) the low rate of capture of eligible patients found in most clinical studies of alcohol misuse may introduce sample bias.⁴⁷

One major question remains: How could the intervention be strengthened, to enable the adolescents we studied to bridge the gap between efforts to change behavior and actual behavior change? Resources are clearly an issue. While 80% of the intervention group received a referral to community youth support organizations, measurement of the quality of those products was not within the scope of this study. The lack of resources in the treatment system for the uninsured was clearly a problem, but adolescents are often unwilling to seek treatment, and might not have entered into a controlled situation even if access were not a problem.⁴⁸⁻⁴⁹ In a future study, it might be useful to consider a family component or follow-up sessions of motivational enhancement therapy to encourage action to bridge the gap. At the three month follow-up visit, a stepped approach might also be useful to assist the subgroup of intervention recipients who reported that they tried to make behavioral changes but were not able to succeed; these enrollees might benefit from low-impact case management. Because there was considerable heterogeneity in the group studied, there may be a need to focus efforts on a more at-risk population, such as those with higher AUDIT scores, or those who arrive after alcohol-related injury. Finally, individually oriented

interventions may have the greatest effect in the context of multi-level strategies that include community action and norms change.

LIMITATIONS

The PED is a challenging environment in which to conduct a study among adolescents. Confidentiality issues required a lengthy consent process, and adolescents and young adults are not characterized developmentally by capacity for patience, especially in situations that involve authority figures. Recruitment of a larger sample might have allowed more depth in analysis of subgroups and relatively rare outcomes. We were, however, able to limit the refusal rate to 21% of eligible patients.

We chose to include adolescents who had low levels of drinking in order to focus on early intervention. When risk is low, however, it is difficult to demonstrate changes in outcomes, not only for alcohol consumption, but especially for rare events such as car crashes or obtaining inpatient alcohol dependence treatment. While universal screening is necessary for identification of alcohol problems among adolescents, this study raises questions about the utility of an ED intervention for adolescents who are identified at low levels of risk.

Follow-up rates were not ideal, despite rigorous application of best practices. However sensitivity analysis did demonstrate an effect for efforts to change, even in the worst case situation of equating loss to follow-up with a negative answer for change attempts.

Findings related to certain subgroups are limited by sample size. In the case of the 57 enrollees followed up at 12 months who were 14–17 years of age, for example, future studies should consider oversampling to ensure the absence of a Type II beta error.

To the best of our knowledge, this is the first randomized, controlled trial of brief alcohol intervention in an inner-city ED with a sample of underage drinkers from diverse racial and ethnic backgrounds not restricted to injured or intoxicated patients. While such investigations are of great importance, generalizability may be necessarily limited. The model used in this study might have different results in a more advantaged population of youth.

Finally, we were limited in intervention design by both participant variables and PED logistics. The intervention had to be deliverable in a brief time, and allow for numerous interruptions for clinical care. Another potential limitation is the time of day, as patients were not enrolled during the night shift, and it is certainly plausible that a disproportionate number of alcohol-related “teachable moments” occur during the night shift.

We were unable to introduce a family component, because the population that uses this PED, even among the 14 to 17 year olds, generally presents for medical care unaccompanied by family; they are alone or with friends. We did demonstrate changes in self-reported quit attempts related to the intervention, but those changes did not produce a sustained effect on the clinically relevant outcomes of consumption and health consequences.

CONCLUSIONS

A controlled trial of an intervention to reduce adolescent alcohol consumption and associated consequences was conducted in an inner-city pediatric emergency department with careful attention to protocol adherence. Brief motivational intervention resulted in significant efforts to change behavior (quit drinking and be careful about situations while drinking), but did not alter between-groups consumption or high-risk behaviors. Future

studies should focus on modalities to strengthen the intervention to address this gap between intent and outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
Consort Diagram

Table 1

Demographic characteristics of enrollees by randomization status

	I (n=283) n (Col %)	AC (n=284) n (Col %)	MAC (n=286) n (Col %)	Total	P-value from chi-square
Age					0.704
≤ 17 years old	35 (12.4)	37 (13.0)	42 (14.7)	114	
≥ 18 years old	248 (87.6)	247 (87.0)	244 (85.3)	739	
Sex					0.814
Male	132 (46.6)	125 (44.0)	131 (45.8)	388	
Female	151 (53.4)	159 (56.0)	155 (54.2)	465	
Race					0.989
American Indian/Alaskan Native	4 (1.4)	5 (1.8)	8 (2.8)	17	
Asian	5 (1.8)	3 (1.1)	4 (1.4)	12	
Black/African American	145 (51.2)	147 (51.8)	146 (51.1)	438	
Hispanic/Latino	54 (19.1)	54 (19.0)	56 (19.6)	164	
Native Hawaiian/Pacific Islander	2 (0.7)	1 (0.4)	1 (0.4)	4	
White	73 (25.8)	74 (26.1)	71 (24.8)	218	
Primary Language					0.953
English	248 (87.6)	245 (86.3)	251 (87.8)	744	
Spanish	21 (7.4)	20 (7.0)	20 (7.0)	61	
Haitian Creole	6 (2.1)	7 (2.5)	7 (2.5)	20	
Cape Verdean	6 (2.1)	6 (2.1)	5 (1.8)	17	
Other	2 (0.7)	6 (2.1)	3 (1.1)	11	

I = intervention group; AC = assessed control group; MAC = minimally assessed control group

Table 2

Baseline consumption and alcohol-associated risk factors (screening survey responses)

Consumption Variables	I (n=283)	AC (n=284)	MAC (n=286)	P- value
AUDIT score, Mean($\pm$ SD)				
≤ 17 years old	6.5 ($\pm$ 4.6)	7.7 ($\pm$ 5.6)	7.4 ($\pm$ 5.4)	0.605
≥ 18 years old	9.1 ($\pm$ 6.1)	8.5 ($\pm$ 6.3)	8.8 ($\pm$ 6.2)	0.609
Drinking days per month	Mean ($\pm$ SD)	6.1 ($\pm$ 6.0)	7.6 ($\pm$ 7.2)	0.089
	Median (IQR)	4 (1.5–7.5)	4 (1.5–14.5)	
Drinks per drinking day in past month	Mean ($\pm$ SD)	5.2 ($\pm$ 5.1)	5.3 ($\pm$ 4.6)	0.613
	Median (IQR)	4 (3–6)	4 (2–6)	
Binge episodes per month (≥5 drinks within a couple of hours)	Mean ($\pm$ SD)	2.7 ($\pm$ 4.0)	2.8 ($\pm$ 4.5)	0.952
	Median (IQR)	1 (0–4)	1 (0–4)	
Risk Behavior Variables, n (%)				
Rode in a car after drinking with person who was drunk or high in past 30 days	106 (38.1)	116 (40.9)	99 (35.0)	0.355
Drove a car after drinking in past 30 days	25 (8.9)	45 (15.9)	23 (8.1)	0.005
Got in fight after drinking in past 30 days	46 (16.6)	41 (14.5)	50 (17.7)	0.582
Got injured after drinking in past 30 days	30 (10.7)	26 (9.2)	28 (9.9)	0.846
Got arrested after drinking in past 30 days	7 (2.5)	6 (2.1)	6 (2.1)	0.939
Any marijuana use in past 30 days	179 (63.3)	174 (61.5)	170 (59.4)	0.646
Have regular source of care	146 (52.1)	142 (50.0)	153 (53.9)	0.652

I = intervention group; AC = assessed control group; MAC = minimally assessed control group; AUDIT = Alcohol Use Disorders Identification Test

Table 3

Comparison of I and AC groups on baseline assessment variables

Risk Assessment Variables	I (n=283) n (%)	AC (n=284) n (%)	P-value from chi- square
Positive PCL-C	92 (32.5)	86 (30.3)	0.568
Positive score for risk-taking (Simpson & Joe)	79 (27.9)	90 (31.7)	0.326
Major or minor depression	30 (10.6)	42 (14.8)	0.134
Friends strongly approve of drinking; pressure to drink more	130 (46.1)	102 (36.2)	0.017
Parents neither approve nor disapprove of drinking	154 (54.6)	145 (51.6)	0.475
Daily use of alcohol has mild or almost no effect on health	49 (17.3)	59 (21.0)	0.267
Any alcohol-involved injury	57 (20.1)	51 (18.0)	0.508

PCL-C = post traumatic stress disorder checklist, civilian version; I = intervention group; AC = assessed control group

Table 4

Percent attempting to change consumption and drinking behaviors, by status at 12 months: all followed enrollees and by subgroup

ATTEMPTS	All Enrollees		AUDIT		PCL-C		AGE	
	n = 416 I vs. AC	High risk n = 179 I vs. AC	Low risk n = 227 I vs. AC	Negative n = 294 I vs. AC	Positive n = 122 I vs. AC	14-17, yrs n = 57 I vs. AC	18-21, yrs n = 359 I vs. AC	
Tried to cut back on drinking	73.3; 64.9 (p=0.065)	75.0; 76.7 NS	71.0; 58.0 (p=0.042)	72.2; 57.7 (p=0.009)	75.8; 83.1 NS	70.0; 77.8 NS	73.9; 63.0 (p=0.028)	
Tried to quit drinking	40.5; 27.8 (p=0.007)	36.3; 29.9 NS	44.9; 26.9 (p=0.005)	32.9; 25.3 NS	58.1; 33.9 (p=0.008)	34.5; 33.3 NS	41.5; 26.9 (p=0.004)	
Tried to be careful when drinking	80.5; 71.3 (p=0.030)	82.6; 74.7 NS	78.3; 69.8 NS	78.3; 66.0 (p=0.019)	85.5; 84.8 NS	73.3; 85.2 NS	81.7; 69.2 (p=0.007)	

AUDIT = Alcohol Use Disorders Identification Test; PCL-C = post traumatic stress disorder checklist, civilian version; I = intervention group; AC = assessed control group

Table 5

Main effects and changes over time in attempts to change consumption and behavior

F/U visit #1: In the last 3 mo. F/U visit #2: Since you enrolled	Visit	OR for a 'YES' response I vs. AC (95% CI)	P-value for AOR	Interaction p-value	Main effect p-value
Have you tried to cut back on drinking?	3 month	2.82 (1.79–4.44)	0.000		
	12 month	1.48 (0.98–2.26)	0.065	0.010	0.000
Have you tried to quit drinking?	3 month	2.01 (1.32–3.05)	0.001	0.635	0.000
	12 month	1.77 (1.17–2.67)	0.007		
Have you tried to be careful about situations you got into when drinking?	3 month	1.72 (1.07–2.78)	0.026		
	12 month	1.66 (1.05–2.62)	0.029	0.899	0.007

F/U = follow up; I = intervention group; AC = assessed control group; AOR = adjusted odds ratio; OR = odds ratio

Table 6

Mixed Effects Linear Regression Model, unadjusted for baseline, from 30 day Time Line Followback (TLFB) calendar

TLFB Variables	Visit	I, Mean (SD)	Change in I, BL to 12 months	AC, Mean (SD)	Change in AC, BL to 12 months	P-value I vs. AC	Interaction p-value	Main effect p-value
Drinking days per month	Baseline	6.7 (4.5)		6.6 (4.5)		0.848		
	3 month	5.5 (4.5)		5.7 (4.5)		0.777		
	12 month	4.9 (4.5)	-1.8	5.1 (4.5)	-1.5	0.752	0.866	0.877
Mean drinks per drinking day	Baseline	5.0 (2.7)		4.6 (2.7)		0.165		
	3 month	4.3 (2.7)		4.0 (2.7)		0.366		
	12 month	3.5 (2.7)	-1.5	3.5 (2.7)	-1.1	0.992	0.480	0.297
Mean drinks per week	Baseline	9.1 (9.1)		7.7 (9.1)		0.170		
	3 month	7.6 (9.1)		6.9 (9.1)		0.503		
	12 month	5.5 (9.1)	-3.6	5.6 (9.1)	-2.1	0.913	0.449	0.369
Maximum drinks per day	Baseline	7.8 (4.4)		7.5 (4.4)		0.656		
	3 month	6.3 (4.4)		6.1 (4.4)		0.722		
	12 month	5.2 (4.4)	-2.6	5.7 (4.4)	-1.8	0.314	0.343	0.947

I = intervention; BL = baseline; AC = assessed control

Table 7

Main effects and changes over time, from 30 day TLFB: GEE and Mixed Effects Linear Regression Models

Part A: CATEGORICAL VARIABLES	Visit	AOR I vs. AC (95% CI)	P-value for AOR	Interaction p-value	Main effect p-value
Carried a weapon	3 month 12 month	0.63 (0.39–1.04) 0.98 (0.57–1.68)	0.071 0.928	0.199	0.232
Had unplanned sex after drinking	3 month 12 month	0.82 (0.51–1.33) 0.82 (0.49–1.38)	0.422 0.461	0.995	0.296
Had sex without condom/birth control after drinking	3 month 12 month	1.06 (0.64–1.77) 1.02 (0.59–1.78)	0.816 0.931	0.919	0.829
Got into a fight after drinking	3 month 12 month	0.73 (0.39–1.37) 0.72 (0.35–1.47)	0.331 0.367	0.970	0.200
Drove a car after drinking	3 month 12 month	1.11 (0.66–1.85) 1.06 (0.62–1.81)	0.699 0.828	0.900	0.695
Rode in a car with a person who was drunk or high after drinking	3 month 12 month	0.89 (0.59–1.34) 1.17 (0.77–1.79)	0.579 0.461	0.248	0.905
Got injured after drinking	3 month 12 month	0.75 (0.27–2.06) 0.56 (0.23–1.36)	0.577 0.200	0.664	0.183
In the past 30 days, got drunk 1+ days	3 month 12 month	0.72 (0.45–1.14) 1.04 (0.68–1.61)	0.162 0.846	0.193	0.469
Got high on alcohol 1+ days (adjusted for BL using # drinking days on TLFB)	3 month 12 month	0.76 (0.49–1.17) 0.96 (0.64–1.45)	0.207 0.858	0.357	0.378
High on marijuana 1+ days (adjusted for BL using days smoked from TLFB)	3 month 12 month	0.75 (0.45–1.23) 1.18 (0.71–1.97)	0.249 0.522	0.134	0.811
High on other drugs 1+ days	3 month 12 month	0.81 (0.44–1.48) 1.15 (0.58–2.27)	0.495 0.693	0.417 [†]	0.818 [†]

Part A: CATEGORICAL VARIABLES		Visit	AOR I vs. AC (95% CI)		P-value for AOR	Interaction p-value	Main effect p-value
Exceeded 5+/4+ drinks (dichotomous)		3 month	1.10 (0.73–1.66)		0.653		
		12 month	1.02 (0.69–1.51)		0.929	0.768	0.731
Part B: CONTINUOUS VARIABLES		Visit	I x (SD)	AC x (SD)	P-value I vs. AC	Interaction p-value	Main effect p-value
Drinking days		3 month	5.5 (4.5)	5.7 (4.5)	0.695		
		12 month	4.9 (4.5)	5.1 (4.5)	0.673	0.986	0.608
Mean drinks per drinking day		3 month	4.2 (2.9)	4.1 (2.9)	0.779		
		12 month	3.4 (2.9)	3.6 (2.9)	0.523	0.474	0.809
Mean drinks per week		3 month	7.4 (7.9)	7.1 (7.9)	0.719		
		12 month	5.3 (7.9)	5.9 (7.9)	0.545	0.430	0.870
Maximum # drinks per day		3 month	6.3 (4.2)	6.1 (4.2)	0.817		
		12 month	5.1 (4.2)	5.8 (4.2)	0.224	0.221	0.531
Days drunk		3 month	3.9 (3.6)	4.5 (3.6)	0.236		
		12 month	4.0 (3.6)	3.7 (3.6)	0.551	0.112	0.739
High on alcohol (adjusted for BL # drinking days by TLFB)		3 month	4.8 (4.6)	4.7 (4.6)	0.927		
		12 month	4.4 (4.6)	3.6 (4.6)	0.184	0.293	0.374
High on marijuana (adjusted for BL #days used from TLFB)		3 month	10.2 (6.6)	9.8 (6.6)	0.668		
		12 month	8.2 (6.6)	7.0 (6.6)	0.211	0.447	0.315
High on other drugs		3 month	0.9 (3.0)	1.3 (3.0)	0.281		
		12 month	0.5 (3.0)	0.6 (3.0)	0.962	0.380 [†]	0.491 [†]

[†] not adjusted for baseline measure

TLFB = Time Line Followback; GEE = generalized estimating equations; I = intervention; BL = baseline; AC = assessed control; AOR = adjusted odds ratio