Screening, Brief Intervention, and Referral for Alcohol Use in Adolescents: A Systematic Review

BACKGROUND AND OBJECTIVE: Alcohol use by adolescents is widespread and is connected to a number of negative health and social outcomes. Adolescents receiving emergent care for injuries are often linked with risky use of alcohol. The trauma system has widely adopted the use of screening, brief intervention, and referral to treatment (SBIRT) for preventing alcohol-related injury recidivism and other negative outcomes. The purpose of this article is to review the evidence around SBIRT with adolescent patients in acute care settings.

METHODS: This article reviews 7 randomized controlled trials evaluating risky drinking interventions among adolescent patients in acute care settings. All studies took place in the emergency departments of level I trauma centers.

RESULTS: Four of the 7 studies reviewed demonstrated a significant intervention effect; however, no one intervention reduced both alcohol consumption and alcohol-related consequences. Two of these 4 studies only included patients ages 18 and older. Subgroup analyses with adolescents engaged in risky alcohol-related behaviors, conducted in 2 of the studies, showed significant intervention effects. Five studies showed positive consumption and/or consequences for all study participants regardless of condition, suggesting that an emergent injury and/or the screening process may have a protective effect.

CONCLUSIONS: Based on existing evidence, it is not clear whether SBIRT is an effective approach to risky alcohol use among adolescent patients in acute care. Additional research is needed around interventions and implementation.

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KEY WORDS
alcohol/drug use, adolescents, injury prevention and control, emergency department

ABBREVIATIONS
ACS-COT—American College of Surgeons Committee on Trauma
ADI—Adolescent Drinking Inventory
AUDIT—Alcohol Use Disorders Identification Test
CI—confidence interval
ED—emergency department
MI—motivational interviewing
OR—odds ratio
PTSD—posttraumatic stress disorder
RCT—randomized controlled trial
SBIRT—screening, brief intervention, and referral to treatment
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surveys suggest that children younger in 7 state and 4 national surveys. The results of these monitoring the Future survey estimates that 39% of adolescents have tried alcohol even before high school.2 The Monitoring the Future survey estimates that 39% of adolescents have tried alcohol by eighth grade. Donovan3 examined alcohol use reported by children sixth grade, suggesting that children as young as 9 years of age, if not younger, may be appropriate for intervention.

Use and misuse of alcohol by adolescents is of great concern because of its association with a number of negative outcomes. In a 30-year prospective study, Ogders et al4 found that adolescents who were exposed to alcohol and illicit drugs before age 15 were at increased risk for addiction, early pregnancy, crime, and sexually transmitted diseases. In a review of the literature, Zeigler et al5 found alcohol use in these formative years increases the risk of developing alcohol use disorders and impairs learning through neurodegeneration, impaired functional brain activity, and neurocognitive deficits. These changes to the brain affect transition to adulthood and intellectual development. In addition, large national interview studies demonstrate a link between earlier drinking age and lifetime alcohol abuse and dependence6 and earlier onset of dependence.7

Relationship to Injury
The literature supports a link between adolescent use of alcohol and injury. A review by Sindelar et al6 found that results of alcohol-screening studies with adolescents demonstrate alcohol-positive rates from 5% in general emergency department (ED) samples to 50% in samples of injured trauma patients. Adolescents found to be positive for alcohol use in the ED report negative outcomes that mirror those reported by early-onset drinkers in the studies mentioned previously. Spirito et al9 found that, in addition to higher levels of alcohol consumption and disorders, alcohol-positive adolescents were also more likely to participate in high-injury risk activities and have previous alcohol-related injuries in comparison with alcohol-negative adolescents. The results of the National Epidemiologic Survey on Alcohol and Related Conditions also demonstrate a link between adolescent drinking and injury. Respondents who initiated drinking before the legal age were significantly more likely to have been injured while drinking and/or unintentionally injure themselves or someone else than those who did not.10,11

Screening for Risky Use of Alcohol in Pediatric Acute Care
Screening Tools
A number of published studies detail the reliability, validity, and feasibility of screening tools for detection of risky drinking behaviors among adolescent populations.12–17 Among the many tools discussed in the literature, some pertinent to adolescents include: the Alcohol Use Disorders Identification Test (AUDIT), the CRAFFT, the Problem Oriented Screening Instrument for Teenagers, the Adolescent Drinking Inventory (ADI), the RUFT-Cut, and the CAGE. These tools provide an additional benefit to biological markers because they account for typical alcohol behaviors over some span of time, not just alcohol consumption immediately preceding the medical visit. Many of the tools also assess drinking patterns, such as binge drinking and driving while drinking. In studies comparing their performance, the AUDIT and the CRAFFT perform well in adolescent populations.13–15 Although research on existing and emerging screening tools is ongoing, it is clear that reliable and valid tools exist for detecting risky use of alcohol by adolescents in medical settings.

Screening Adolescents in Acute Care Settings
A number of studies have examined the screening process among injured adolescent patients in acute care settings. Screening processes can identify more drinkers if they go beyond biochemical testing and observed intoxication. Sindelar-Manning et al18 found that biochemical testing alone did not sufficiently identify alcohol problems among adolescent patients who were also tested by using the AUDIT and the ADI. Medical providers may significantly underestimate levels of alcohol and drug problems among their adolescent patients.19 and when providers do screen, it appears their decisions may be biased. In retrospective chart reviews of ED patients aged 13 to 19 years, Colby et al20 found that physicians were more likely to order tests for patients who were male, injured, older, and treated during nights and weekends, even though a large proportion of patients being treated for alcohol intoxication at the hospital were noninjured females.

SBIRT and the Trauma System
The American College of Surgeons Committee on Trauma (ACS-COT) sets criteria for the care of trauma patients.21 Level I trauma centers have the highest capability, followed by level II and level III trauma centers. Hospitals can also meet criteria for the care of pediatric trauma
patients and verify as level I or level II pediatric trauma centers. As of March 24, 2011, the ACS-COT has verified 33 level I and 24 level II pediatric trauma centers. Pediatric trauma patients are generally <15 years of age, although some pediatric and joint pediatric-adult trauma centers may accept older patients.

One of the criteria for level I and II trauma centers concerns screening, brief intervention, and referral to treatment (SBIRT) for patients with risky drinking behaviors. Trauma centers at both levels must have a mechanism in place to screen for risky drinking and refer patients to treatment; level I centers must also have the ability to provide those who screen positive with a brief intervention. The ACS-COT does not advise or require specific screening tool(s), intervention strategies, modes of delivery, referrals to treatment, or directions specific to the age of the patient.

A number of guides have been published to aid trauma centers in SBIRT program implementation; however, implementation guidelines specific to SBIRT programs for children and adolescents in acute care facilities have yet to be developed.

Implementation of SBIRT programs with adolescents varies across trauma and acute care programs. In a study of 177 hospitals treating patients <18 years of age, screening of adolescents in the ED was reported by 18% of the responding hospitals. 26% reported screening admitted trauma patients. Screening was initiated at a variety of ages, and there was no consistent age cutoff point identified. Hospitals reported use of blood alcohol levels as a screening tool at 51% of the hospitals. Other assessment tools (eg, the AUDIT, CRAFFT, CAGE, or another tool) were used for screening at 61% of the responding hospitals. At 31% of the hospitals, the assessment consisted of questions incorporated into a general hospital assessment. At least 1 additional study examining implementation of SBIRT in pediatric acute care settings is currently underway.

**OBJECTIVE**

The purpose of this article is to review the evidence concerning SBIRT for risky alcohol use among adolescent patients in acute care settings through a review of randomized controlled trials (RCTs). Considerations for future research will also be addressed.

**STUDY SELECTION**

We have been able to locate 7 RCTs that examined brief interventions for alcohol use by adolescent patients in acute care settings. Studies were located through Internet-based searches by using Google Scholar and PubMed. Searches were conducted by using various combinations of these terms: adolescent, pediatric, alcohol, drinking, risky drinking, alcohol misuse, injury, brief intervention, SBIRT, motivational interview, hospital, acute care, emergency department, and randomized controlled trial. Additionally, bibliographies of review articles and original research studies were reviewed to assist in identification of RCTs. Articles examining brief interventions for alcohol use were included given the study met the following criteria: was conducted in an acute care setting in the United States; was empirical research that was randomized, interventional in nature focusing on alcohol use; was not a secondary analysis; and included participants within the adolescent age range (ie, 11–21 years of age).

Study selection was a 2-phase process conducted by 3 researchers independently. Phase 1 consisted of reviewing the title and abstract of articles published before January 2011. If inclusion criteria were met or uncertainty existed, the article continued to the second phase, which consisted of a manual review. When uncertainty existed, 2 researchers manually reviewed the article and discussed it until a consensus was reached. Sixty-one studies were manually examined. A total of 54 studies were removed in phase 2 because of meeting exclusion criteria, resulting in 7 studies being included in this systematic review (Supplemental Table 1).

**RESULTS**

**Description of the RCTs**

All of the identified studies took place in the EDs of level I trauma centers. Ages of patients included in the studies varied widely; the study with the youngest age boundary included patients 12 to 20 years of age, and the study with the highest age boundary included patients 18 to 24 years of age. Each of these enrolled participants fell, at least partially, within the American Academy of Pediatrics definition of adolescent, ages 11 through 21 years. Three of the studies used only patients who were receiving treatment of an alcohol-related event, and 2 included only patients who were being treated for an injury, and 1 included patients being treated for injury or illness (Supplemental Table 2).

The studies used a variety of different measurement tools (Supplemental Table 3) and followed patients for either 6- or 12-month periods. One of the studies addressed a variety of other injury risks with their intervention, and another addressed violence in conjunction with alcohol use. The study conducted by Maio et al is the only one to include patients without a positive screen on some measure of alcohol use.

All but one of the studies used motivational interviewing (MI) as the foundation for the intervention (Supplemental Table 4). MI is a directive and client-centered counseling style intended to minimize resistance and increase intrinsic motivation to change. MI has been widely used in brief interventions for risky use of alcohol.
study delivered the intervention through an interactive computer program based on social learning theory.28

Study Results
The first of the studies, conducted by Monti et al,51 involved older adolescents, 18 and 19 years of age (n = 94), who presented to the ED with either a positive blood alcohol concentration or self-report of alcohol use. Participants in the intervention group were provided with a MI intervention, a personalized feedback sheet, and written resources. Participants in the control group were provided with a handout on avoiding drinking and driving and a list of resources for treatment.

Both the intervention and control groups reduced their drinking at 3 and 6 months after their ED visit (P < .001), with no significant differences between the intervention and control groups. Participants in the control group were significantly more likely to report drinking and driving (odds ratio [OR] = 3.92, 95% confidence interval [CI] = 1.21–12.72, P < .05) and have a moving violation (OR = 3.94, 95% CI = 1.45–10.74, P < .01). The intervention group was significantly less likely to report an alcohol-related injury than those in the control group during the 6 months after the ED visit (21% vs 50%, P < .01). Those in the intervention group also had significantly fewer alcohol-related problems (eg, problems with friends, parents, or police) in the 6-month follow-up period compared with controls (0.88 ± 1.18 vs 1.45 ± 1.43, P < .05).

Johnston et al29 conducted an RCT testing the effects of a MI-based intervention designed to reduce injury risk in a number of topic areas among 12- to 20-year-old adolescents receiving injury treatment in an ED. After baseline screening, participants in the intervention group selected one of the risk areas identified by the screening to address in an MI session with a therapist. Risk areas assessed and potentially addressed by the intervention included seatbelt use, bicycle helmet use, driving after drinking, and/or riding with an impaired driver, binge drinking, and carrying a weapon. The 3 alcohol-related risk areas (driving after drinking, riding with an impaired driver, and binge drinking) were rarely selected by the patient for discussion during the therapist MI session; of 631 patients were enrolled in the study (intervention group, n = 318; control group, n = 312), only 2 participants in the intervention group received an MI for driving after drinking, 8 for riding with an impaired driver, and 13 for binge drinking. The control group received only standard medical care. There were no significant differences between the intervention and control groups on alcohol-related outcomes (driving after drinking, riding with an impaired driver, or binge drinking) at 3- and 6-month follow-up assessments. Participants in both groups reduced prevalence of risk behaviors, including alcohol-related risk behaviors, at both 3- and 6-month follow-up assessments compared with baseline.

Spirito et al32 tested a brief MI intervention among a sample of 13-to 17-year-old patients (n = 152) who were treated in an ED for an alcohol-related event. The intervention group participated in an MI and received written resources. The control group received standard care, defined as 5 minutes of brief advice and written resources. Both the intervention and control groups reduced drinking during the 1-year study period. The intervention group did not differ from the control group on outcome measures of alcohol use, or on engaging in drinking and driving, alcohol-related injury recidivism, or alcohol-related problems (eg, problems with friends or school). Among a subgroup of adolescents who scored above the clinical cutoff for referral on the ADI at baseline, those who were in the intervention group reduced their number of drinking days per month (P < .01) and their frequency of high-volume drinking (P < .01) significantly more than those in the control group.

Maio et al30 conducted an RCT in an ED comparing an interactive computer program-based intervention with standard of care among 14- to 18-year-old patients (n = 655). The intervention was based on social learning theory and had previously shown success in a school setting.38 While engaged with the computer program, participants visited virtual rooms at a party and interacted with cartoon characters. Participants made choices at the party and received feedback from the characters on their choices. There were no significant differences between the intervention and control groups on alcohol misuse or binge drinking measures. At 3 months, both the intervention and control group participants showed a reduction in alcohol misuse and binge drinking, however, at 12 months, these levels had returned to baseline. Among a subgroup of participants who admitted drinking and driving at baseline, the intervention group showed greater improvement on alcohol misuse compared with controls, as did a subgroup of patients admitting to recently riding with an intoxicated driver.

A subsequent RCT study by Monti et al30 examined an MI intervention compared with a feedback-only control group among older patients, 18 to 24 years of age (n = 198), who were receiving ED treatment of an alcohol-related event. The intervention group received telephone booster sessions at 1 and 3 months after the ED visit. Both groups significantly reduced alcohol consumption (number of days drinking, heavy drinking days, and drinks per week) at both 6- and 12-month follow-ups. The intervention group had significantly larger reductions in all 3 consumption outcomes compared with the control group at both the 6- and 12-month assessments (P < .01 or .001 on all
outcomes at both time points). In contrast to findings from their previous study,31 there were no significant differences between groups in alcohol-related injury events or moving violations.

Walton et al33 included adolescent patients 14 to 18 years of age (n = 726) who screened positive for both alcohol use and aggression. Patients who were positive only for alcohol use were not included in the study. Patients were randomly assigned to either the control group or 1 of 2 intervention groups. The intervention was delivered either by a trained therapist or through an interactive computer program.

All 3 groups reduced alcohol misuse at 3 months (P = .01) and 6 months, binge drinking at 3 months (P < .001) and 6 months, and alcohol consequences at 3 months (P < .001), with no significant differences between groups. Participants in both of the intervention groups were less likely to report ≥2 alcohol consequences (eg, missing school) at the 6-month follow-up assessment compared with the control group (P = .03). The effect was stronger for those in the therapist intervention condition than those in the computer intervention condition. When alcohol consequences were analyzed as frequencies rather than dichotomized variables, there were no significant differences between the intervention and control groups.

Bernstein and colleagues34 conducted a 3-group randomized assignment trial to examine the impact the intervention, a brief MI delivered by peer educators who were <25 year of age, has on alcohol consumption and related risks. Participants were 14- to 21-year-old adolescents who presented to a pediatric ED. The adolescents were randomly assigned to 1 of 3 groups: the minimally assessed control group, who only received screening survey; the standard assessment group, who also received additional assessment instruments; and the intervention group.

Compared with the standard assessment group, the intervention group was more likely to report efforts to quit drinking at 3 months (P = .001) and 12 months (P < .01), be careful about situations when drinking at 3 months (P < .05) and 12 months (P < .05), and cut back on drinking at 3 months (P < .001). In the subgroup of participants with AUDIT scores below the clinical cutoff, the intervention group was more likely to report efforts to quit drinking and/or cut back on drinking. In the subgroup of participants who were positive for posttraumatic stress disorder (PTSD) via the Post Traumatic Stress Disorder Checklist - Civilian, the intervention group was more likely to report efforts to be careful about situations when drinking and/or cut back on drinking. In the subgroup of older participants (18–21 years of age), the intervention group was more likely to report efforts to quit drinking, to be careful about situations when drinking, and/or to cut back on drinking. There was no significant difference on measures of alcohol consumption frequency. Because of the rarity of the number of accidents, alcohol-related admissions, injuries, sexually transmitted infections, pregnancies, and amount of treatment received from state-funded sources for alcohol problems, power was low and too small for statically meaningful comparisons between groups.34

DISCUSSION

Results of the 7 studies are inconclusive. Three of the 7 RCTs reviewed showed no differences between the intervention and control groups when looking at the population as a whole on either alcohol consumption or consequences.29,30,32 Six of the 7 studies reviewed showed positive alcohol consumption and/or consequences effects for all participants regardless of study condition.29–34 The one study that did not show sustained positive effects among both groups28 did not restrict its sample to injured patients or to patients who screened positive for risky use of alcohol. Therefore, it is possible that screening for risky alcohol use and/or sustaining an injury may have a protective effect, either in isolation or in concert with one another.

Among the 4 studies that did demonstrate a significant intervention effect, no 1 intervention was decisively effective for reducing both alcohol consumption and alcohol-related consequences among intervention groups compared with controls. Monti et al31 showed a significant intervention effect on alcohol-related consequences, including drinking and driving, moving violations, alcohol-related injury, and alcohol-related problems, but not on consumption. In contrast, the later study by Monti, et al30 showed a significant intervention effect on consumption variables, including drinking days, heavy-drinking days, and mean number of drinks per week, but no intervention effect on consequences. Walton et al33 found an intervention effect on alcohol consequences at 6 months, but this effect was not seen at 3 months and did not hold true when the variable was analyzed as a frequency (rather than dichotomized as ≥2 consequences vs <2 consequences). They found no intervention effect on consumption variables. Bernstein and colleagues34 found a significant intervention effect on cutting back and/or quitting drinking at 3 months and 12 months. However, these researchers only found a significant intervention effect on being careful about situations when drinking at 3 months, and no intervention effect was found for alcohol-related consequences. The 2 studies showing the most positive findings30,31 only included patients aged 18 and older. In pediatric trauma centers, patients are generally <15 years
of age,\textsuperscript{21} although the age limits do vary. The studies that included patients of younger ages demonstrated essentially no intervention effect on alcohol-related outcomes.

SBIRT in pediatric acute care settings is not without promise. Two of the studies found significant intervention effects in subgroup analyses.\textsuperscript{28,32} In both, the patient subgroups exhibited higher engagement in risky alcohol-related behaviors at baseline (drinking while driving\textsuperscript{29} and higher severity of alcohol involvement).\textsuperscript{30}

**Future Research Directions**

There are a number of areas where future research will be especially useful in developing interventions for risky-drinking adolescents. First, there is an overall need for future studies to have more consistent methodology (eg, outcome measures, inclusion criteria) so the results can support decisive conclusions and policy changes. Second, additional studies are needed to strengthen the evidence base supporting widespread implementation of SBIRT for adolescents in acute care, and these studies should incorporate a variety of approaches to the brief intervention. Although MI has been the most studied, and therefore shows the most promise in studies conducted to date, even assessment and feedback appear to have a positive effect. Further development and testing of interventions based on other behavior change models could be useful, because the MI-based interventions tested to date have yet to demonstrate consistent success with younger adolescents. Third, future studies need to help to assess some of the practical considerations for SBIRT programs. The most important of these may be to determine at what age SBIRT becomes effective. Therefore, comparisons should be made between this systematic review and reviews of SBIRT used with adult patients in EDs.\textsuperscript{39,40}

Fourth, the location of SBIRT delivery may be a factor in its effectiveness that requires the need for comparisons of this review with those examining the screening and brief interventions used in settings other than EDs.\textsuperscript{41–48}

Finally, it appears that there may be a need to further assess whether SBIRT is effective as a universal screening and primary prevention intervention, or if it is more indicated for certain groups of adolescents (eg, adolescents of a certain age, those who are consistently engaging in risky use of alcohol and/or risky alcohol-related behaviors). This is especially important based on the findings of 2 studies where significant differences between the intervention and control groups were found only in subgroup analyses\textsuperscript{28,32} and on the fact that 3 studies included participants with positive blood alcohol concentrations, which only measures 1 point in time instead of consistent alcohol use.\textsuperscript{50–52}

Additionally, perhaps other outcome measures need to be incorporated (eg, intention or desire to drink in the future), as alcohol consumption and consequences may not be sufficient to measure an interventions’ effect among adolescents who are not yet drinking.

Future studies of brief intervention for adolescent use of alcohol also need to attend to developmental and demographic differences among study populations. Cooper et al\textsuperscript{48} found that there may be important differences between black and white youth’s motivation to consume alcohol. According to their results, coping motives played a larger role among black youth, and enhancement motives were stronger among white youth. A study by Horton\textsuperscript{50} found that although black youth had lower levels of alcohol use in adolescence and young adulthood, early onset of use appeared to have a stronger effect on drinking and alcohol problems than for their white counterparts. Research is severely lacking among Hispanic and non–English-speaking populations.

There may be a need for future research to further examine the utility of brief interventions for adolescent drug use. In 1 study, among adolescent trauma patients who received screening, more patients screened positive for drugs (marijuana and opiates) than for alcohol.\textsuperscript{51} Brief MI interventions have also shown promise for marijuana use in adolescents.\textsuperscript{52} If brief interventions are eventually proven to definitively impact adolescents’ use of alcohol, and, perhaps even if not, there is a need to evaluate the approach with drug use.

In summary, the results of the 7 RCTs evaluating SBIRT for risky drinking among adolescents in acute care are inconclusive. The findings of the 4 studies demonstrating significant intervention effects were inconsistent. Two studies found significant differences among intervention and control groups within a subgroup of the study sample, suggesting promise with adolescents who are engaged with risky alcohol-related behaviors. Additional RCTs are warranted, especially among younger adolescents. There is also a need for implementation research and guidelines specific to pediatric acute care settings.

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BIOCHEMISTRY AT WORK: A few days ago, a first-year medical student whom I know well remarked to me that he was really looking forward to the end of the first year of medical school and that he could not wait to begin clinical work later in the second year. While not an unfamiliar lament, it always makes me wonder why biochemistry or genetics, a mainstay of curricular work in the first year, is not more fascinating to students. After all, biochemistry is essential to life and survival. Maybe we should spice up lectures with some really intriguing and easily seen examples of biochemistry at work. Take the skunk, for example. Why do animals give the skunk a wide birth? As reported in The New York Times (Science: January 31, 2012), skunks synthesize toxins in anal sweat glands that are loaded with thiols. Thiols are generally found in high concentrations in lethal environments such as those with high hydrogen sulfide and low oxygen concentrations. Most mammalian olfactory glands, including those of the human, can detect remarkably small amounts of thiols in the environment. Skunks take advantage of this olfactory warning system and can either release a mist to impede a chasing predator or squirt a stream directly into the face.

The crested rat takes a different approach. The rat chews the bark and roots of the Acokanthera tree from which it extracts a remarkably potent curare-like toxin. The rat then spreads the toxic saliva over specialized hairs along its flank. The toxin-impregnated saliva seeps through the hair and into hollow microfibers where it is stored. Predators taking a nip are inoculated with the toxin and either become quite ill or die. Why the crested rat is not affected by the toxin is not known. However, rat behavior provides some clues. Rats are not picky about what they eat, but if they try to eat something truly unpalatable, they spit it out and lick their fur as a way to clean their mouth. Maybe an early crested rat experienced the ill effects of the bark toxin but also was protected from predators by the presence of the toxin in the fur. Crested rats able to tolerate the toxin eventually had a survival advantage. Now the crested rat is dependent on the tree. Were the tree to disappear, the rat would lose a critical host defense mechanism. I doubt the biochemistry of skunk anal sweat glands or crested rat saliva will soon be introduced into our curriculum, but it sure would be fun.
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