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Age of Drinking Onset as a Moderator of the Efficacy of Parent-Based, Brief Motivational, and Combined Intervention Approaches to Reduce Drinking and Consequences Among College Students

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Abstract

Background—The current study tested age of onset as a moderator of intervention efficacy on drinking and consequence outcomes among a high-risk population of college students (i.e., former high school athletes).

Methods—Students were randomized to one of four conditions: assessment only control, combined parent-based intervention (PBI) and brief motivational intervention (BMI), PBI alone, and BMI alone. Participants (n = 1,275) completed web-administered measures at baseline (summer before starting college) and 10-month follow-up.

Results—Overall, the combined intervention demonstrated the strongest and most consistent reductions across all outcomes, particularly with the youngest initiators. Participants who initiated drinking at the youngest ages had significantly lower peak drinking, typical weekly drinking, and reported consequences at follow-up when they received the combined intervention when compared to the control group. The BMI and PBI groups, when examined independently, demonstrated significant effects across outcomes but were inconsistent across the different age groups.

Conclusion—Results suggest the combination of a PBI and a peer-delivered BMI is an appropriate and efficacious way to reduce drinking and related consequences among individuals who initiated drinking earlier in adolescence and are at an increased risk of experiencing alcohol problems.

Keywords

Age of Drinking Onset; Prevention; College Students; Parent

In an attempt to curb dangerous drinking practices on college campuses, research has focused on reducing high-risk alcohol consumption among college students (Larimer and Cronce, 2002, 2007; NIAAA, 2007). Epidemiological studies have shown 69% of individuals who met criteria for alcohol dependence were dependent before the age of 25 (i.e., the age encompassing the majority of college students; Hingson et al., 2006a).

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Intervention efforts have been directed toward the general student population (Larimer et al., 2007; Turrisi et al., 2001), as well as high-risk subgroups including Greek members and heavy drinking college students (Carey et al., 2006; Fournier et al., 2004; Larimer et al., 2001; Marlatt et al., 1998). Given the nature of the positive relationship between heavy alcohol consumption and likelihood of experiencing negative consequences, an integral component of college alcohol interventions focuses on reducing the amount of alcohol consumed and risk of experiencing related consequences (Dimeff et al., 1999; Turrisi et al., 2001).

SELECT RISK FACTORS RELEVANT TO COLLEGE STUDENTS

Research has shown individuals who participate in college and/or high school athletics are among those at highest risk for risky alcohol consumption in college, second only to Greek members (Ford, 2007; Hildebrand et al., 2001; Martens et al., 2006; Turrisi et al., 2006, 2007; Wechsler and Nelson, 2001). This high-risk group makes up a substantial portion of college student bodies with some university populations comprised of over 70% of former high school athletes (Doumas et al., 2006; Hildebrand et al., 2001). Despite being a high-risk subgroup and having a large presence on many college campuses, relatively few interventions have specifically targeted student athletes (Larimer and Cronce, 2002, 2007). Until recently, a long held belief was that involvement in athletics served as a protective factor for drinking and other risky behaviors based on the seminal work on college drinking conducted by Strauss and Bacon (1953) diverting focus away from implementing interventions with these individuals.

In addition to social and group factors that contribute to increased risk related to drinking, individual factors also play a role in risky alcohol consumption. Early age of drinking onset has been shown in several studies to be associated with high-risk drinking and related problems during adolescence, the college years, and beyond (e.g., Dawson et al., 2008; Grant and Dawson, 1997; Grant et al., 2001; Hingson et al., 2000, 2006b; Muthen and Muthen, 2000; Warner and White, 2003). College students who participated in high school athletics have been shown to initiate drinking at an earlier age than their nonathlete classmates. For example, studies have shown that as many as one-third of college students with a background in athletics report initiating alcohol use in middle school compared to less than one quarter of nonathletes (Hildebrand et al., 2001). In addition, high school athletes exhibit a similar pattern to college students in that they drink more than their nonathletic peers while in high school (Wetherill and Fromme, 2007), demonstrating that this pattern of drinking is established during adolescence and maintained in emerging adulthood.

INTERVENTIONS ADDRESSING ATHLETES AND AGE OF ONSET

Despite the association of early age of drinking onset with sustaining serious injuries and alcohol dependence (Hingson et al., 2000, 2006b), little is known about the success of existing alcohol-related interventions in reducing alcohol consumption among college students who initiated early relative to their peers. While limited in scope, research efforts have targeted athletes using social norms-based feedback and skills training (Gregory, 2001; Perkins and Craig, 2006; Thombs and Hamilton, 2002). None of the tested interventions resulted in a decrease in drinking behavior despite correcting normative misperceptions regarding peer alcohol consumption and were limited in that they did not include no-treatment control groups (Turrisi et al., 2006).

Recently, studies have started to examine the efficacy of individual-based interventions in athletes and former athletes making the transition to college using controlled research trials (Turrisi et al., 2009). Brief motivational interventions (BMI: Borsari and Carey, 2000;

Dimeff et al., 1999) and parent-based interventions (PBI: Turrisi et al., 2001) have shown efficacy in reducing college drinking. While these interventions are efficacious, they were created for different purposes. The BMI was designed with a focus on heavier drinkers and treatment (e.g., Dimeff et al., 1999), while the PBI focused on prevention/early intervention and has shown efficacy in reducing risky drinking among college students during their freshman year (Turrisi et al., 2001). BMI interventions have been modified (e.g., delivered by peers instead of professionals, delivered via the mail/computer instead of in person) and have been shown to reduce drinking among high-risk Greek students (Larimer et al., 2001) and delay initiation of drinking among abstainers (Larimer et al., 2007), demonstrating the ability of this approach to be relevant and useful for a variety of drinker types.

The combination of both the PBI and BMI is similar to a two-tiered approach using both parent and peers to facilitate the interventions. Our rationale for combining these two specific interventions is that parents and peers represent the two most important spheres of influence that have been studied in the alcohol literature on college students. Moreover, parents and peers represent the two most frequent and important referents that students turn to regularly for advice, support, and modeling. We believe that the combined condition serves to make the messages from these critical referents more credible to the extent that they are consistent. Using this approach, Turrisi and colleagues (2009) found that among high school athletes transitioning to college, individuals randomized to a combined PBI/BMI condition drank significantly fewer drinks during peak drinking, typical week, and weekend occasions compared to groups receiving only the PBI or the no-treatment control. In addition, participants in the combined condition experienced significantly fewer consequences as measured by the Rutgers Alcohol Problem Index (RAPI; White and Labouvie, 1989) at follow-up compared to those in the PBI only, BMI only, and control groups. This finding demonstrates that high-risk drinkers may need more intensive alcohol interventions delivered at different times via multiple modalities to have a significant impact on drinking.

While the combined use of the PBI and BMI has shown promise among athletes, it is not entirely clear how age of onset of drinking interacts with intervention efficacy. We therefore focused on examining age of onset as a moderator of the BMI, PBI, and combined intervention. Individuals who are athletes and initiate drinking early in adolescence are most in need of efficacious interventions as they are at a substantially increased risk of engaging in dangerous drinking and experiencing alcohol-related problems. Considering the literature does not support a directional hypothesis, two possible outcomes are plausible. First, the intervention effects would be greater for those whose drinking habits are less well established and thus more open to change (i.e., 17- and 18-year-olds versus 14- and 15-year-olds). We anticipate that the BMI and PBI will result in significant reductions in drinking and consequences on their own; however, when they are combined, we expect to observe greater reductions across outcomes. Second, because research has shown that brief motivational interventions are efficacious with heavy-drinkers (e.g., Marlatt et al., 1998), it is equally plausible that the BMI and combined intervention may be more efficacious among early initiators (e.g., 14 and younger) whose drinking habits are more established, especially in the combined condition where dosage is greatest.

FOCUS OF CURRENT STUDY

The current study builds on the research of Turrisi and colleagues (2009) by examining age of onset of drinking as a moderator of the efficacy of the PBI, BMI, and combined PBI/BMI in a high-risk sample of high school athletes during their freshman year of college. Turrisi and colleagues (2009) only found consistent effects across typical weekly drinking, weekend drinking, peak drinking, and consequences as measured by the RAPI for the combined

condition. BMI alone and PBI alone were not efficacious across all drinking-related outcomes. The current study expands on previous work (Turrisi et al., 2009) by examining age of onset as a moderator for the BMI, PBI, and combined effect on peak and weekly drinking as well as related consequences. Our analyses examined the efficacy of the BMI, PBI, and combined conditions in reducing drinking at the spring (10-month postbaseline) assessment in individuals initiating alcohol use at different ages to examine long-term, sustained effects of the interventions.

MATERIALS AND METHODS

Participants and Recruitment

Participants were recruited as part of a longitudinal, multisite study conducted at both a large, public northeastern university (site A) and a large, public northwestern university (site B) during the summer of 2006 just prior to college matriculation. For a more detailed description of the original efficacy study, please refer to Turrisi and colleagues (2009). All procedures were reviewed and approved by the Institutional Review Boards at both sites. Incoming freshmen (N = 4,000) were randomly selected from the registrar's database of all incoming students (regardless of athletic status) at each site and mailed an invitation letter containing information about the study and a URL and personal identification number (PIN) to access an online screening survey. Inclusion criteria for the study consisted of (i) providing consent to participate, (ii) completion of the online screening assessment, (iii) participation in high school athletics, and (iv) completion of the baseline assessment following the screening survey.

One thousand eight hundred and three students provided their consent to participate and completed the screening survey, yielding an initial response rate of 45% (which is similar to other studies on college student drinking using Internet-based recruitment; e.g., Larimer et al., 2007; McCabe et al., 2005; Thombs et al., 2005). Of these students, 79% (n = 1,419) reported participating in high school athletics, of whom 1,275 completed baseline assessment. Participants were randomized to one of four conditions including BMI only, PBI only, combined BMI + PBI, or assessment only control. A 10-month postbaseline follow-up assessment was conducted during the spring semester with a retention rate of 86% (n = 1,096). Compensation for the assessments was as follows: $10 for screening, $25 for the baseline survey, and $35 for the follow-up assessment. Participants who completed a BMI session were also asked to complete a brief session evaluation for which they received $10.

With respect to sample demographics, 44.4% identified as men (n = 566) and 55.6% identified as women (n = 709); 4.5% identified as Hispanic or Latino(a), 79.8% as Caucasian, 10.1% as Asian, 3.7% as Multiracial, 2.0% as African American, 0.5% as Native Hawaiian or Other Pacific Islander, 0.2% as American Indian/Alaskan Native, 3.2% as Other and 0.4% did not identify race/ethnicity. These proportions were representative of the freshman class from the campuses from which respondents were drawn and no sample bias was observed. As reported in Turrisi and colleagues (2009), no significant group by campus interactions was observed. Thus, the data were combined across sites. Considering a RCT design was utilized, data were collected at multiple campuses in varying geographic regions, and no evidence of interactions by campus was found, we believe our findings generalize beyond our specific samples and are valid.

Intervention Procedure

Brief Motivational Intervention (BMI)—BMI sessions (Dimeff et al., 1999; Marlatt et al., 1998) were led by a trained student facilitator and lasted approximately 45–60 minutes.

During the session, the facilitator and participant reviewed computer-generated motivational feedback based on the participant's baseline assessment. The feedback in the current study was consistent with the work of Dimeff and colleagues (1999); as well as other research studies that adopt this approach (Larimer et al., 2001, 2007) and included components related to normative feedback, expectancy challenge, negative consequences, and protective behavioral strategies. Student facilitators presented the information in a motivational interviewing (MI; Miller and Rollnick, 2002) style. Feedback sheets were mailed to participants who were unable to attend the BMI meeting (Larimer et al., 2007).

Parent-Based Intervention (PBI)—Consistent with the parent intervention implemented by Turrisi and colleagues (2001), parents of participants randomized to receive the PBI were mailed a handbook during the summer prior to teens' matriculation to college. The handbook was 35 pages in length and included facts about college student drinking, strategies and techniques for communicating with teens in an effective manner, tips on ways to help teens develop assertiveness and resist peer pressure, and in-depth educational information on how alcohol works on the body. The handbook was accompanied by a letter which asked parents to read the materials, fill out a brief evaluation, and provide feedback on the actual handbook itself, as well as discuss the information in the handbook with their student during the summer.

Fidelity data for both interventions are provided in Turrisi and colleagues (2009).

Control Group Procedures—Participants randomized to the control group were asked to complete all procedures similar to those randomized to the other conditions with the exception that intervention materials (feedback sheets and parent materials) were mailed at the end of the spring semester of their freshman year, after completion of the 10-month follow-up.

Measures

All participants completed measures at baseline and again at the 10-month postbaseline follow-up.

Alcohol Use—Peak drinking was assessed using the Quantity/Frequency/Peak questionnaire (QFP; Dimeff et al., 1999; Marlatt et al., 1998), which asks participants to write the maximum number of drinks they consumed on a peak occasion within the 30 days prior to the assessment. Participants were also asked to indicate the number of drinks they consumed on each day of a typical week using the Daily Drinking Questionnaire (DDQ; Collins et al., 1985). Responses were summed for total number of drinks during a typical week. A standard drink definition was included for all measures [i.e., 12 oz. beer, 10 oz. wine cooler, 4 oz. wine, 1 oz. 100 proof (1¼ oz. 80 proof) liquor].

Alcohol-Related Consequences—The 23-item RAPI (White and Labouvie, 1989) was used to assess alcohol consequences within the past 3 months. Participants indicated the number of times they experienced each consequence on a scale from Never (0) to *More than 10 times* (4).

Age of Onset—To assess age of onset of drinking, participants were asked to indicate the "First time they tried alcohol, more than a few sips." Response options included "*I have never drank alcohol*," "*Age 10 or younger*," "*11*," "*12*," "*13*," "*14*," "*15*," "*16*," "*17*," "*18*," "*19*," "*20*," *or* "*21 or older*." This scale has been used in multiple studies (e.g., Hingson et al., 2006b).

RESULTS

Analytic Strategy

The focus of these analyses was to extend the work of Turrisi and colleagues (2009), by examining age of drinking onset as a moderator of each intervention condition's efficacy on drinking and consequence outcomes at 10-month follow-up while controlling for baseline drinking and consequences. As in the initial efficacy study, analyses were conducted on the entire sample regardless of whether they completed the intervention (intent to treat) because no differences were observed between the intent to treat sample and those who completed treatment. In addition, the authors tested for baseline equivalence of several drinking outcomes and observed no significant differences across conditions.

Based on the recommendations of the APA task force on statistical inference (Wilkinson, 1999), Tukey's HSD planned comparisons were conducted to compare drinking outcomes for the PBI, BMI, and combined treatment group (PBI + BMI) when compared to the control group for each age associated with onset of alcohol use to test our expectations regarding differences for different age at onset. Actual differences between intervention groups and control group drinking and consequence means at the 10-month follow-up assessment controlling for baseline drinking variables were calculated and compared to the Tukey's critical difference to assess the significance of the outcome. Because of the number of Tukey's tests performed, a significance level of $p < 0.01$ was used to reduce the possible occurrence of Type I errors.

We observed a very small percentage of participants (e.g., <6%) who reported age of onset prior to age 14; thus, we collapsed previously described response options ranging from age *10 or younger to age 14* as one response option. Further, no participants reported age of onset beyond age 18 because baseline surveys were administered during the summer prior to college matriculation. For analytic purposes, the variable was recoded as follows: *age 14 or younger* (0), *age 15* (1), *age 16* (2), *age 17* (3), *age 18* (4), and *abstainers* (5).

Missing Data and Outliers—Missing data on our variables were minor within session (<1%) and low from baseline to follow-up (<15%). Thus, we subjected all of the variables in our analyses simultaneously to a maximum likelihood approach (EM in SPSS) recommended by Schafer and Graham (2002). Finally, based on the recommendations of Tabachnick and Fidell (2001), extreme outliers on the peak drinking measure which were extremely low in frequency (e.g., <1%) were rescored to a unit greater than the largest nonoutlying value (e.g., 3.29 standard deviations above the mean) to achieve acceptable levels of skewness and kurtosis in the univariate distributions (e.g., <2 and 4, respectively).

Descriptives

Table 1 displays the percentage of all study participants that initiated at each age of onset category (i.e., age 14 or younger, age 15, age 16, etc.) at baseline. Results reveal the percentage of students who first tried alcohol increased from ages fourteen or younger through age 16, slightly decreased from ages 16 to 17, and then declined at age 18. Nearly one-fifth of the sample identified as an abstainer at baseline, which is consistent with previous research (e.g., Wechsler et al., 1998). In addition, differences between age groups (controlling for gender) were examined with regard to baseline drinking and consequences. These analyses revealed significant differences between the age groups for peak occasions [$F(5,1260) = 83.56$, $p < 0.001$, $eta^2 = 0.25$], the typical week [$F(5,1260) = 58.18$, $p < 0.001$, $eta^2 = 0.19$], and consequences [$F(5,1260) = 48.73$, $p < 0.001$, $eta^2 = 0.16$]. Follow-up comparisons using Tukey's revealed participants who initiated alcohol use at the age of 14 or younger drank significantly more during a typical week than all other initiators. We also

observed that 15-year-olds endorsed higher drinking rates than older initiators. No significant differences were observed between those who initiated at 14 or younger and those who initiated at 15 on peak drinking occasions; however, these groups drank significantly more than older initiators. A similar pattern was observed when baseline rates of consequences were examined in that younger initiators (14- and 15-year-olds) reported experiencing more consequences than older initiators at baseline. The results displayed in Table 1 also demonstrate a consistent pattern of lighter alcohol consumption and fewer reported consequences as age of onset increases. Taken together, these findings support that an early age of onset is related to higher risk drinking and related problems among college students. The means and standard deviations for all age groups and outcomes are located in Table 1.

Age of Onset as a Moderator of Intervention Efficacy

Peak Drinking—Tukey's HSD planned comparisons were conducted on data collected at the 10-month follow-up assessment. As shown in Table 2, participants in the combined condition who initiated drinking at all age levels (with the exception of baseline abstainers) drank significantly less during peak drinking occasions at the 10-month follow-up compared to the control group. Baseline abstainers in the combined condition drank significantly more than their counterparts in the control group; however, their mean peak consumption was still relatively low (i.e., <2 drinks). Individuals in the BMI group drank significantly less during peak drinking occasions than those in the control group with the exception of those who initiated drinking at 16 and baseline abstainers. Finally, participants in the PBI group who initiated at ages 14, 16, and 17 reported consuming significantly less alcohol during peak drinking occasions than participants in the control group.

Typical Weekly Drinking—As shown in Table 3, participants in both the BMI and combined interventions who initiated at ages 14, 15, 17, and 18 consumed fewer drinks per week compared to controls. Participants in the PBI condition who initiated drinking at ages 16 and 17 drank significantly fewer drinks per week compared to controls. An iatrogenic effect was observed among individuals in the PBI condition who initiated at age 14 or younger in that they drank significantly more than their age-matched controls.

Alcohol-Related Consequences—Participants in the combined condition who initiated alcohol use at ages 14, 15, and 18 reported experiencing significantly fewer consequences during their freshman year compared to control participants (see Table 4). Similar findings were revealed for participants in the BMI condition who initiated at ages 15 and 17. Within the PBI, only those that initiated at age 17 showed a signifi-cant reduction in consequences compared to controls. Signifi-cant iatrogenic effects were observed for the youngest initiators (14 and younger) in the PBI group and 18-year-old initiators and abstainers at baseline in the BMI group.

DISCUSSION

Our study examined age of onset of alcohol consumption as a moderator of the efficacy of a PBI, BMI, and the combination of the two on reducing drinking and consequences in a high-risk sample of college students during their freshman year. Our results indicated that the efficacy of the combined interventions was the most consistent, but the BMI and PBI alone varied depending on the age of drinking onset and drinking-related outcomes. One possible result we proposed was that the intervention effects would be greater for those whose drinking habits are less established and thus more open to change (i.e., later initiators relative to earlier initiators). We also proposed it was plausible for more change to occur among early initiators whose drinking habits were more established, based on the success of

BMIs among heavy drinkers (e.g., Larimer et al., 2001; Marlatt et al., 1998). Further, it was anticipated that the combined intervention would be the most efficacious among younger initiators considering the dosage was greatest of the three interventions. Although these seem to be competing possibilities, we were pleasantly surprised our findings provided at least partial support for both.

With regard to peak alcohol consumption, individuals who initiated at the earliest ages (i.e., 14 and 15) and in later adolescence (i.e., 17 and 18) consumed more alcohol in the absence of an intervention relative to those exposed to the BMI, PBI, and combined conditions. The earliest initiators (14 and younger) who were randomized to the combined and BMI conditions drank approximately three drinks fewer on peak-drinking occasions compared to age-matched controls. Surprisingly, no significant differences were found between baseline abstainers in the intervention and control groups with the exception of an iatrogenic effect observed in the combined condition. It is important to note this pattern of findings was not consistent across the other outcomes and individuals in the combined condition who abstained at baseline reported significantly fewer consequences at follow-up compared to controls. Studies have demonstrated that a mailed BMI delayed the initiation of drinking among abstainers (Larimer et al., 2007); however, more research is needed to understand the long-term drinking trajectories of these individuals once they initiate drinking. Considering baseline abstainers in the combined condition reported consuming on average less than two drinks on their peak drinking occasion and experienced significantly fewer consequences at follow-up, these findings were not overly alarming. The pattern of behavior observed is consistent with the harm reduction philosophy underlying the BMI and the PBI which both share the common goal of discouraging high-risk drinking and negative consequences among college students.

A different pattern of findings emerged when examining typical weekly drinking as the outcome variable. Individuals across all ages in both the BMI and combined conditions drank fewer drinks per week compared to controls with the exception of 16-year-olds and baseline abstainers. The PBI group showed significant reductions among 16- and 17-year-old initiators but resulted in an iatrogenic effect among individuals who initiated drinking at ages 14 and younger. A similar iatrogenic effect was observed among this age group when examining alcohol-related consequences. There are many possible reasons for this effect (e.g., parents of younger initiators may have different communication and monitoring practices or the relationship has changed because of numerous transgressions of the child over time), and more research is needed to understand this finding.

When examining alcohol-related consequences, an interesting pattern of findings emerged. Overall, the combined group had the most consistent results in reducing consequences while both the BMI and PBI demonstrated some iatrogenic effects and showed less consistent positive effects. While not all age groups in the combined condition experienced significantly fewer consequences compared to controls, the majority had a positive response and no iatrogenic effects were observed. Specifically, among participants who initiated drinking at 14 or younger, only the combined intervention was efficacious in significantly reducing consequences. This is particularly promising and relevant in light of research that has shown early initiators are at an increased risk of experiencing chronic alcohol problems. It was surprising to find the PBI had an iatrogenic effect and the BMI had no effect among this age group. One possible explanation is that the increased dosage and multiple modes of content and delivery present in the combined condition enhanced its efficacy among this particularly high-risk subgroup.

Considering all of the outcomes presented in Tables 2 to 4, it seems that for students who had an age of onset of 15 and 14 or younger, results favored the combined condition, for 16–

17-year-olds, it seems to favor PBI, for 18-year-olds the combined condition seems better, and for the abstainers, no significant treatment effects were observed which may be attributed to low drinking and consequence rates observed in this group at follow-up. Although our research provides suggestions regarding what might be the best interventions for different age of onset groups, it is unclear why this occurred. Future research is needed to explore why the different age groups responded to the interventions in the ways they did.

Limitations and Future Directions

A first limitation is that the data are self-report and retrospective in nature. We took several steps to increase the probability of honest and accurate responding. First, participants were assured that their responses were confidential and were told they could refrain from answering questions which made them feel uncomfortable. With regard to the retrospective nature of the data, most items were given a fairly short reference time to recall (i.e., past month) with the exception of the age of onset item. Individuals who initiated earlier in adolescence (e.g., 14 or younger) may have had more difficulty with accurate recall. Therefore, we chose an item that has been used extensively in the literature (e.g., Hingson et al., 2006b). It should be noted we coded the age of onset variable in a slightly different manner than in past epidemiological studies that examined a large variety of individuals including those who did not attend college. As expected, we observed lower rates of early initiators (i.e., 14 and younger) compared to other studies. One possibility for this finding is that individuals who initiate in pre-adolescence may be less likely to enter college. More longitudinal work in this area is needed. Third, it is plausible that given our response rate early onset drinkers and heavier drinkers may have been less likely to participate. We suspect this is not the case for several reasons. First, our data on demographics prior to respondents logging on to the online survey map onto the campus demographics closely. Second, our drinking rates using internet recruitment were similar to our prior studies using other forms of recruitment where response rates are in the 80% range (Turrisi et al., 2001). Third, our proportions of early-onset drinkers are similar to other research examining age of drinking onset among college students using a national sample with a higher response rate (e.g., Hingson et al., 2003). Thus, we opted to use internet recruitment because it was less labor intensive and less costly knowing our response rates might decrease. However, based on the above results we have confidence that our approach did not result in a biased sample. Finally, these findings are specific to college students who were high school athletes and may not generalize to nonathlete groups.

It is important to note, while the PBI, BMI, and combined conditions were efficacious in reducing alcohol consumption on peak drinking occasions, individuals still consumed a significant amount of alcohol (e.g., >5 drinks) during a single occasion in several of the age categories. The findings together suggest that the reduction in risky drinking and related consequences is a problem that warrants a multifaceted solution. While the combined PBI and BMI intervention has shown efficacy in reducing high-risk drinking and consequences in this population, more work is needed to enhance efficacy of these approaches and evaluate their impact in combination with other evidence-based approaches. In addition, it is important to note that in some cases, iatrogenic effects were observed across different ages and outcomes. Therefore, some of the beneficial findings should be tempered and interpreted with caution considering drinking and consequences increased in a small minority of cases. Future research would benefit in exploring underlying causal factors contributing to these findings.

CONCLUSION

Findings from this study suggest that interventions combining a parent-based handbook and peer-delivered brief motivational feedback session are an appropriate and efficacious way to

reduce high-risk drinking and consequences among individuals who initiated drinking earlier in adolescence (and therefore at an increased risk for engaging in risky alcohol use and experiencing problems) as well as for those who initiated toward the end of high school. Without an intervention, these individuals escalated their alcohol consumption and the number of consequences experienced when they transitioned to college. However, our study showed that individuals who began drinking prior to attending college, including the earliest initiators, responded well to empirically based interventions delivered at a higher dosage and tended to reduce their alcohol consumption and related consequences and maintained these reductions throughout their freshman year.

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Table 1

Age of Drinking Onset and Baseline Drinking and Consequences for all Study Participants

Age of drinking onset	% of participants (*n*)	Peak drinking M (SD)	Weekly drinking M (SD)	Consequences M (SD)
14 and younger	12.7 (162)	6.54 (5.15)	8.70[a] (9.49)	5.97 (7.33)
15 years old	15.9 (203)	6.24 (4.67)	7.38[b] (8.06)	4.69 (4.92)
16 years old	22.5 (287)	4.77[ab] (4.20)	4.48[ab] (5.76)	3.23[b] (4.24)
17 years old	21.0 (268)	3.49[ab] (4.06)	2.80[ab] (6.43)	2.25[ab] (4.20)
18 years old	9.8 (125)	3.00[ab] (3.72)	1.50[ab] (2.90)	1.18[ab] (1.81)
Abstainers at baseline	17.8 (227)	0.00[ab] (0.00)	0.00[ab] (0.00)	0.00[ab] (0.00)

[a]Denotes a significant ($p < 0.05$) mean difference for a given age group compared to the 15-year-old group.

[b]Denotes a significant ($p < 0.05$) mean difference for a given age group compared to the 14 and younger group.

Table 2

Peak Drinking Means at 10-Month Follow-Up Controlling for Baseline Peak Drinking

	Intervention groups			
Age of drinking onset	**Control M (SD)**	**Combined M (SD)**	**BMI M (SD)**	**PBI M (SD)**
14 and younger	9.47 (5.90)	6.48[a] (4.71)	6.44[a] (5.14)	8.74[a] (6.46)
15 years old	7.89 (6.09)	6.80[a] (4.26)	6.68[a] (4.67)	7.92 (4.48)
16 years old	7.12 (4.62)	6.15[a] (5.13)	6.64 (4.78)	6.39[a] (4.61)
17 years old	6.64 (4.63)	5.88[a] (5.41)	4.21[a] (4.64)	5.07[a] (5.21)
18 years old	6.28 (6.64)	4.00[a] (4.52)	5.48[a] (4.15)	6.07 (4.54)
Abstainers at baseline	1.21 (2.46)	1.90[b] (4.05)	1.61 (2.97)	1.53 (2.84)

BMI, brief motivational intervention; PBI, parent-based intervention.

[a]Denotes a significant ($p < 0.01$) mean difference for a given intervention group compared to the control group.

[b]Denotes a significant ($p < 0.01$) iatrogenic mean difference for a given intervention group compared to the control group.

Table 3

Weekly Drinking Means at 10-Month Follow-Up Controlling for Baseline Weekly Drinking

	Intervention groups			
Age of drinking onset	**Control M (SD)**	**Combined M (SD)**	**BMI M (SD)**	**PBI M (SD)**
14 and younger	12.10 (9.03)	9.70[a] (7.76)	10.80[a] (9.43)	13.31[b] (12.26)
15 years old	12.40 (10.44)	9.79[a] (8.19)	8.83[a] (8.66)	13.18 (9.58)
16 years old	9.92 (8.55)	9.85 (10.58)	9.59 (9.13)	9.00[a] (7.75)
17 years old	9.79 (7.87)	8.76[a] (9.46)	5.96[a] (7.78)	7.80[a] (11.24)
18 years old	7.72 (10.84)	4.91[a] (7.93)	5.65[a] (5.04)	6.89 (7.50)
Abstainers at baseline	1.39 (3.63)	1.20 (3.25)	1.50 (2.80)	1.71 (3.33)

BMI, brief motivational intervention; PBI, parent-based intervention.

[a]Denotes a significant ($p < 0.01$) mean difference for a given intervention group compared to the control group.

[b]Denotes a significant ($p < 0.01$) iatrogenic mean difference for a given intervention group compared to the control group.

Table 4

Total Consequence Score Means at 10-Month Follow-Up Controlling for Baseline Consequences

	Intervention groups			
Age of drinking onset	**Control M (SD)**	**Combined M (SD)**	**BMI M (SD)**	**PBI M (SD)**
14 and younger	6.48 (5.84)	4.20[a] (4.46)	6.64 (7.06)	7.23[b] (9.58)
15 years old	8.15 (6.74)	4.26[a] (6.01)	6.20[a] (8.92)	8.79 (9.71)
16 years old	4.68 (5.06)	5.54 (7.75)	5.52 (6.96)	4.32 (5.35)
17 years old	5.28 (8.15)	5.53 (8.02)	3.68* (5.15)	2.27* (3.48)
18 years old	2.88 (4.85)	1.26[a] (1.54)	4.78[b] (5.87)	2.52 (3.56)
Abstainers at baseline	0.39 (1.04)	0.42 (1.09)	1.11[b] (2.93)	0.67 (1.69)

BMI, brief motivational intervention; PBI, parent-based intervention.

[a]Denotes a significant ($p < 0.01$) mean difference for a given intervention group compared to the control group.

[b]Denotes a significant ($p < 0.01$) iatrogenic mean difference for a given intervention group compared to the control group.