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Risks associated with alcohol and marijuana use among college student athletes: The case for involving athletic personnel in prevention and intervention

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Abstract

The purpose of this study was to describe alcohol and marijuana use patterns and related consequences among student athletes. A total of 12,510 students (n=1,233 athletes) completed four cross-sectional online annual surveys as part of a multi-site campus initiative. Chi-square tests of independence, t-tests, and regression models evaluated differences in alcohol and marijuana use between athletes and non-athletes. The prevalence of binge drinking and high intensity drinking was significantly higher among student athletes than non-athletes, even after controlling for demographic characteristics. Thirteen percent of student athletes experienced an alcohol-related injury during the past year; this was more common among binge drinkers than non-binge drinkers (20.5% and 2.6%, respectively). Among student athletes, past-month binge drinking and past-year marijuana use were significantly associated with lowered GPA (ps<.01). Skipping class was twice as prevalent among student athletes who used marijuana as compared with athletes who did not use marijuana, but no differences were found related to binge drinking. Components for a training for athletic personnel to reduce risks for alcohol-related injury and academic consequences that are associated with alcohol and marijuana use among student athletes are described. Involving athletic personnel might be an important strategy to identify and intervene with high-risk student athletes.

Keywords

Student athlete; alcohol; marijuana; consequences; intervention

Introduction

Substance Use among College Students

Magnitude.—The most commonly used substances among college students are alcohol and marijuana. Recent data from the Monitoring the Future study found that 62% of U.S. college students have consumed alcohol at least once during the past 30 days, 33% have had five or more drinks in a row during the past two weeks (i.e., binge drinking), and 10% engaged in

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binge drinking five or more times during the past month. More than one-third (38%) of U.S. college students have used marijuana during the past 30 days (Schulenberg et al., 2018; Substance Abuse and Mental Health Services Administration, 2018). Marijuana use also overlaps significantly with excessive drinking (Meda et al., 2017). Meda et al. (2017) found that among a sample of 1,138 college students almost all marijuana users were also heavy drinkers.

Consequences.—College students can experience a variety of adverse consequences as a result of their substance use. Excessive drinking increases risk for alcohol-related overdose (Hingson, Zha, & Smyth, 2017), accidental injury (Hingson et al., 2017), unprotected sex (Scott-Sheldon, Carey, Cunningham, Johnson, & Carey, 2016), and neglecting responsibilities (El Ansari, Stock, & Mills, 2013). Marijuana use is associated with cognitive impairment (Curran et al., 2016) and can increase the risk for mental health problems (Gobbi et al., 2019). Academic disengagement, namely skipping class, has been observed in association with both excessive drinking and marijuana use (Arria et al., 2013b; Bolin, Pate, & McClintock, 2017). Subsequently, grades can decline, which heightens the risk for dropout or delays in graduation (Arria et al., 2013a; Arria, Caldeira, Bugbee, Vincent, & O'Grady, 2015; Bolin et al., 2017; Meda et al., 2017; Suerken et al., 2016).

Excessive Drinking and Marijuana Use among College Student Athletes

Magnitude.—College student athletes, including National Collegiate Athletic Association (NCAA) student athletes, intramural, and club team participants, have been shown to have more frequent and heavier drinking patterns than their non-athlete counterparts (Barry, Howell, Riplinger, & Piazza-Gardner, 2015; Doumas, Turrisi, Coll, & Haralson, 2007). Data from four Southern universities found that 47% of all athletes binge drank during the past two weeks, significantly more than non-athletes [32% (Tewksbury, Higgins, & Mustaine, 2008)]. This estimate is similar to other studies utilizing different samples and different methods that found that college student athletes have higher-risk drinking patterns than non-athletes, including online and paper surveys of college student samples from 119 four-year schools (Ford, 2007a; Green, Nelson, & Hartmann, 2014), 44 two-year and four-year schools (Barry et al., 2015), 14 public four-year universities in California (Marzell, Morrison, Mair, Moynihan, & Gruenewald, 2015), and one large university in the Northeast (Yusko, Buckman, White, & Pandina, 2008).

Among a large sample of first-year student athletes, alcohol-marijuana use was the second most prevalent form of polysubstance use, following only alcohol-tobacco use (Orsini, Milroy, Wyrick, & Sanders, 2018). The prevalence of marijuana use appears to be lower among student athletes than non-athletes (Ford, 2007b; National College Athletic Association, 2018; Yusko et al., 2008). However, it is not uncommon in both men's and women's college sports, with approximately one-third of male and one-quarter of female student athletes having used marijuana during the past year (Buckman, Yusko, Farris, White, & Pandina, 2011; Ford, 2007b; National College Athletic Association, 2018; Yusko et al., 2008). This is particularly concerning given that marijuana use could result in suspension or expulsion from a team, since marijuana use is banned by the NCAA (Wilfert, 2017).

Risk factors.—Among student athletes, several risk factors are associated with excessive drinking. Student athletes who participate in team sports such as baseball, hockey, and soccer tend to drink more heavily than students who participate in individual sports such as track and field (Brenner & Swanik, 2007; Ford, 2007b), possibly due to social pressures arising from the interdependent, collaborative culture of team sports. Student athletes also overestimate their teammates' drinking patterns (Grossbard, Hummer, LaBrie, Pederson, & Neighbors, 2009). In some team cultures, excessive drinking is a form of positive reinforcement for good performance; heavy drinking is more common among student athletes who perceive alcohol to be a reward for hard work (Pitts, Chow, & Donohue, 2019). Interestingly, athletes who have been on a team longer or who have leadership positions appear to have heavier alcohol consumption patterns compared with newcomers (Leichliter, Meilman, Presley, & Cashin, 1998; Tomon & Ting, 2010). This finding might be explained by the fact that older students have easier access to alcohol. Less alcohol consumption occurs during the active time of sport participation (i.e., "on-season") than during the "off-season" (Brenner & Swanik, 2007). With respect to gender, male student athletes appear to drink more and be at higher risk for heavy drinking than female student athletes (Brenner & Swanik, 2007; Grossbard et al., 2009; Yusko et al., 2008). Male athletes have also been found to drink more and have higher-risk drinking patterns than non-athlete males in multiple studies, although the evidence is mixed for females (Green et al., 2014; Yusko et al., 2008). Past-year cigarette use, being white, having inflated perceptions of normative student use, and higher levels of sensation-seeking are associated with past-year marijuana use among male and female student athletes (Buckman et al., 2011).

Consequences.—Multiple studies have found that student athletes experience more and more frequent negative consequences due to their drinking than non-athletes including neglecting their responsibilities, driving after drinking, having unprotected sex, experiencing sexual assault, and physically injuring themselves, which is of particular concern for student athletes (Barry et al., 2015; Grossbard, Geisner, Neighbors, Kilmer, & Larimer, 2007). Beyond simply a higher prevalence of excessive drinking, Yusko et al. (2008) suggested that the increased risk for experiencing alcohol-related consequences is related to greater levels of sensation-seeking among student athletes. Team traditions (e.g., how winning a competition is celebrated) could also increase how much time student athletes spend in risky environments such as parties or bars (Grossbard et al., 2007).

It is well recognized that becoming injured as a result of alcohol consumption can have a particularly detrimental impact on a student athlete's ability to play or perform optimally. Brenner et al. (2014a) conducted a cross-sectional study of NCAA athletes and found that 18% had experienced an alcohol-related injury during their lifetime, with most of these occurring within their first two years as college students. Not surprisingly, the risk for experiencing an injury linearly increased with severity of drinking pattern, with the highest risk drinking having a six-fold increase in injury risk as compared with low-risk drinkers. A survey of college athletic trainers indicated that trainers treated, evaluated, or referred an average of three alcohol-related injuries during an academic year (Brenner, Metz, Entriken, & Brenner, 2014b). Almost three-quarters of the athletic trainers considered alcohol-related

injury to be a serious problem among their athletes, with 80% of alcohol-related injuries causing the athlete to miss practice or some other athletic event.

Drinking after a game could impact the body's ability to recover from either a "wear and tear" injury or a more serious injury. Both the diuretic and anti-inflammatory effects of alcohol consumption have been speculated to increase injury recovery time (Vella & Cameron-Smith, 2010). Paradoxically, the inflammatory response is part of recovery, and both chronic and acute alcohol consumption appear to interfere with this process on multiple levels (Barnes, 2014; Kawaratani et al., 2013; Mandrekar, Catalano, White, & Szabo, 2006; Molina, Gardner, Souza-Smith, & Whitaker, 2014). Alcohol consumption can indirectly displace carbohydrate and protein intake and protein synthesis, which might impede glycogen synthesis and storage, which is required for recovery (Burke et al., 2003; Parr et al., 2014). Alcohol consumption can also have negative effects on athletic performance, such as diminished aerobic performance, impaired motor skills, and reduced blood flow to muscles (Barnes, 2014; Vella & Cameron-Smith, 2010); however, alcohol consumption among athletes is much more common following competition than it is during or immediately preceding competition (Barnes, 2014). Therefore, the influence of alcohol on recovery from injury is likely to be of greater relevance for student athletes.

Prior studies have not focused on academic-related consequences from excessive drinking and marijuana use among student athletes. While academic problems are potentially serious for all students, academic disengagement can be particularly detrimental for student athletes, especially if a student is receiving a scholarship that requires maintenance of a minimum GPA. For most college athletic programs, a minimum GPA is required, and failing to meet this could put one's student athlete status in jeopardy.

Using a Public Health Framework to Address College Student Substance Use

The use of a public health framework has resulted in significant progress to understand how best to address the complex issue of excessive drinking and marijuana use among college students (Centers for Disease Control and Prevention, 2014). The public health approach uses four steps. First, data are analyzed to raise awareness, and understand the magnitude, correlates, and consequences of the problem. Second, additional data analysis can hone in on suspected risk factors which might be modified to prevent the problem and identify high-risk subgroups within a population. Next, interventions that target these risk factors or high-risk individuals are designed and tested. To reduce college student substance use, a multi-pronged approach is necessary that involves policy enforcement, reducing access and availability of substances in the environment, as well as identifying and intervening with high-risk students such as athletes or individuals involved in Greek life (Arria & Jernigan, 2018; National Institute on Alcohol Abuse and Alcoholism, 2015). For these high-risk subgroups, research indicates that education-only programs, when used in isolation, are not effective in reducing drinking among high-risk college students (Babor et al., 2010). Rather, the research supports individual brief intervention rooted in motivational interviewing (MI) principles, including the Brief Alcohol Screening in College Students (BASICS) program (Cronce & Larimer, 2011; Dimeff, Baer, Kivlahan, & Marlatt, 1999; Larimer & Cronce, 2007; Miller & Rollnick, 2012). The last step in the public health approach is to implement

these evidence-based interventions with individuals at risk. This requires the involvement of individuals who are not care providers themselves, but rather are people who can help direct at-risk and affected individuals to the appropriate level of care. In the present context, athletic personnel constitute such a group. These non-traditional personnel include coaches, trainers, academic advisors, and sports psychologists, all of whom interact regularly with student athletes.

By using data to educate athletic personnel about the scope of the problem and how excessive drinking and marijuana use might compromise the health and academic success of student athletes, they become critical to addressing the problem. Athletic personnel can be involved in addressing excessive drinking and marijuana use in three key ways. First, they can be involved in prevention efforts, which seek to keep students from initiating excessive drinking and marijuana use. Second, they can engage in early intervention efforts, in which they identify student athletes who have risky patterns of alcohol or marijuana use but might not yet be experiencing negative consequences. Third, for students already experiencing problems related to alcohol and/or marijuana use, athletic personnel can play a role in intervention by facilitating access to more formal treatment services.

Coaches and trainers play key roles in establishing team norms and serving as role models for their athletes. A review of the literature indicated that coaches and athletic personnel have greater influence than they might realize regarding team norms and behaviors and might be the first ones to notice negative consequences of drinking (Howell, Barry, & Pitney, 2015; Mastroleo, Marzell, Turrisi, & Borsari, 2012; Nolt, Sachs, & Brenner, 2013; Pitts, Chow, & Yang, 2017; Seitz, Wyrick, Rulison, Strack, & Fearnow-Kenney, 2014). Norms set by coaches and trainers could discourage or promote drinking, and taking actions such as setting clear team policies around alcohol consumption might reinforce the message that drinking can have detrimental effects on athletic performance (Pitts et al., 2017; Seitz et al., 2014). A survey of athletic trainers found that 80% agreed that they should receive more training to recognize problematic alcohol consumption among student athletes (Brenner et al., 2014b). Some attempts have been made to target athletic personnel to reduce team drinking levels (Cimini et al., 2015; Nolt, 2014). In an intervention designed specifically for athletes, in which sports psychologists were trained in using MI techniques to discuss alcohol consumption, significant reductions were observed for alcohol consumption, alcohol-related negative consequences, greater use of protective drinking behaviors, and reductions in their perceptions of other students' weekly drinking at the 3-month follow up (Cimini et al., 2015).

Method

Research Questions

Although prior research has established that student athletes are a subgroup at risk for excessive drinking and injury-related consequences, fewer studies have focused on marijuana use among student athletes. Furthermore, no prior research to our knowledge has examined the associations between alcohol consumption patterns, marijuana use, and academic variables (i.e., skipping class and GPA). To address these gaps, provide a contemporary view of alcohol drinking patterns and marijuana use among student athletes,

and advance the development of trainings for athletic personnel, this study aimed to answer two research questions. First, what are the alcohol and marijuana use patterns among college student athletes? Second, are alcohol and marijuana use patterns associated with alcohol-related injury and academic consequences? The findings can then serve as the foundation of a training for athletic personnel to address excessive drinking and marijuana use among student athletes.

Data Source

The data emanated from the Maryland College Alcohol Survey (MD-CAS) which is the primary data collection tool to measure the magnitude and correlates of drinking patterns among college students attending the member schools of the Maryland Collaborative to Reduce College Drinking and Related Problems. The Maryland Collaborative is a state-funded initiative that provides technical assistance and training to institutions of higher education to align their alcohol prevention strategies with evidence-based practices (Arria & Jernigan, 2018).

The MD-CAS is administered annually during the two to four weeks prior to spring break at colleges and universities in Maryland, including four-year private schools, four-year public schools, and two-year community colleges. Data for the present analyses come from the first four cross-sectional years of the MD-CAS (2014 to 2017). Thirteen schools participated in at least one year of data collection. The survey was administered online each year with the exception of one school in 2014 which chose to administer paper surveys. The majority of schools offered incentives of varying value for completing the survey; funding for incentives was unavailable at several schools. The cumulative response rate across the four years of data collection was 20.6%, with annual response rates ranging from 16.4% in 2017 to 23.0% in 2014; this is comparable with other web-based national surveys of college students like the National College Health Assessment (NCHA), which in 2017 had a mean response rate of 19% (American College Health Association, 2017). Institutional Review Board approval was received from all participating schools, and informed consent was obtained from all participants.

Sample

For the analyses, eligibility was restricted to full-time undergraduate students ages 18 to 25 at four-year universities to maintain a focus on traditional students who are at a higher risk for excessive drinking than non-traditional students (Dawson, Grant, Stinson, & Chou, 2004). Students were excluded if they: a) did not provide a response to the question about athlete status; or b) were missing usable responses to all alcohol items. Therefore, the analytic sample consisted of 12,510 full-time undergraduate students ages 18 to 25, of whom 1,233 (9.9%) were athletes. These students came from eleven schools, representing NCAA Division I and Division III athletic programs.

Measures

Alcohol consumption.—Frequency of past-month alcohol consumption and past-month binge drinking were assessed using standard items (Centers for Disease Control and Prevention, 2012). Students were asked on how many days during the past month they

consumed five or more drinks (for males) or four or more drinks (for females) in a row or within a couple hours (Centers for Disease Control and Prevention, 2012); these responses were later was later dichotomized as "Never" versus "One or more times" during the past month. Typical quantity was assessed as the number of drinks usually consumed per drinking day during the past month. High intensity drinking was derived from two items that captured the typical and maximum number of drinks they consumed on drinking days during the past month. Students were categorized as high-intensity drinkers if either their typical or maximum quantity was ten or more drinks (Patrick & Terry-McElrath, 2017). For all alcohol consumption items, past-year non-drinkers were automatically coded as 0 for past-month frequency and typical quantity and not engaging in the behavior for the binge drinking and high intensity drinking variables. The alcohol consumption variables were assessed during all four years of data collection.

Marijuana use.—Students were asked how often they used any type of marijuana during the past year, with five response options ranging from "Never" to "Daily" (The Core Institute, 2013). Responses were later dichotomized as "Never" versus all other responses. Marijuana use was assessed during the second, third, and fourth years.

Alcohol-related injury.—Students who drank during the past year were asked how often they got hurt or injured as a result of their drinking during the past year. Six ordinal response options ranging from "Never" to "10 or more times" and were dichotomized as "Never" ("Not Injured") versus all other responses ("Injured"). Students who did not drink during the past year were not asked these questions, and were automatically coded as not experiencing an alcohol-related injury. This item was asked during all four years of data collection.

Academic variables.—Cumulative grade point average (GPA) was self-reported, and was assessed during the second, third, and fourth years. Skipping class was assessed using the item "During the past year, how often did you skip class?" The four response options were later dichotomized as "Never" or "Rarely" versus "Sometimes" or "Often." This was measured during the third and fourth years of data collection.

Athlete status.—Student athlete status was self-reported in response to an item that asked if they were regularly involved with an intercollegiate athletic team. This item was asked during all four years of data collection.

Demographic characteristics.—Age, sex, current living situation, year in school, and race/ethnicity were also self-reported. Students were permitted to endorse multiple categories for the race/ethnicity question. These responses were later recoded to create mutually exclusive categories. Students who endorsed more than one race were coded as "Two or more races." The demographic characteristics were assessed during all four years of data collection.

Statistical Analyses

Descriptive statistics, chi-square tests of independence, and independent samples t-tests were used to evaluate differences in alcohol consumption, marijuana use, and demographic

characteristics between athletes and non-athletes. Logistic regression and linear regression models were then developed to examine these differences while controlling for age, sex, race/ethnicity, and living situation. Estimated marginal means were obtained from the regression models.

To inform the development of a training tailored for athletic personnel, the analyses examining the consequences associated with alcohol and marijuana use (namely alcohol-related injury, GPA, and skipping class) were restricted to athletes only. Chi-square tests of independence and independent samples t-tests were used to evaluate differences by categories of substance use patterns. All analyses were conducted using IBM® SPSS® Statistics version 24.

Results

Sample Characteristics

Significantly more student athletes were male (40.0%) and younger than age 21 (70.8%) than among the non-athletes (32.7% and 61.8%, respectively; see Table 1). The majority of both samples were non-Hispanic white, although racial minorities were underrepresented among athletes.

Comparison of Athletes and Non-athletes on Alcohol Consumption and Marijuana Use

After statistically controlling for demographic characteristics, athlete status was positively associated with quantity but not frequency of alcohol consumption (see Table 2). Athletes consumed alcohol on 4.2 days during the past month, which was not significantly different than non-athletes (4.0, p=.096; see Figure 1a). Compared with non-athletes, athletes consumed an additional 0.7 drinks per drinking day (p<.001). Episodes of excessive drinking were also more common among athletes; 53.3% of student athletes engaged in binge drinking during the past month compared with 41.2% of non-athletes (p<.001) and 17.6% of athletes engaged in high intensity drinking, which was nearly twice as high as among non-athletes (9.8%; p<.001; see Figure 1b and Table 3). Past-year marijuana use was significantly less prevalent among student athletes than non-athletes (28.7% vs. 33.3%, respectively, p<.01).

Alcohol Consumption and Alcohol-related Injury

Overall, 12.9% of student athletes had experienced an alcohol-related injury during the past year. Experiencing an alcohol-related injury during the past year was nearly eight times higher among student athletes who binge drank during the past month, compared with non-binge drinking student athletes (20.5% vs. 2.6%, respectively, p<.001; see Figure 2).

Alcohol Consumption, Marijuana Use, and Academic Variables

Among student athletes, mean cumulative GPA was negatively associated with substance use. Past-month binge drinkers had a mean GPA of 3.27, compared with 3.38 among student athletes who did not binge drink (p<.01). Similarly, student athletes who used marijuana during the past year had a GPA of 3.24 compared with 3.35 among non-users (p<.01; see Figure 3a).

Among student athletes, the prevalence of skipping class did not differ between binge drinkers and non-binge drinkers (21.5% and 15.6%, respectively; see Figure 3b). However, the proportion of past-year marijuana users who skipped class sometimes or regularly was twice as high as the proportion of non-users (28.5% vs. 14.3%, respectively, $p<.001$).

Post-hoc Analysis on Marijuana Use

To assess whether or not dichotomizing marijuana use as past-year use vs. non-use might obscure the relationship between marijuana use and the academic variables, the analyses were conducted using the five-level marijuana use variable. The majority of the student athletes (66.3%) did not use marijuana during the past year. Approximately one in five athletes (19.1%) used marijuana less than monthly, whereas small proportions used marijuana monthly (5.2%), weekly (5.2%), or daily (4.2%). The mean GPA of daily marijuana users (3.00) was significantly lower than the GPAs of never and less-than-monthly users (3.34 and 3.30, respectively, $ps<.05$). Although the prevalence of skipping class sometimes or regularly was twice as high among daily users than among non-users (29.4% vs. 14.3%), this difference was not statistically significant, likely due to small sample sizes (n=31 for daily users).

Discussion

The findings of this study with respect to the elevated risk for excessive drinking and similar risk for marijuana use among college student athletes as compared with non-athletes are largely consistent with the prior literature (Ford, 2007a; Green et al., 2014; Tewksbury et al., 2008), as is the finding that excessive drinking is associated with a heightened risk for injury among student athletes (Brenner et al., 2014a). This study provides new information about the possible academic-related consequences of both excessive drinking and marijuana use among student athletes. Namely, marijuana use and binge drinking were both associated with lower GPAs among student athletes, while only marijuana use was associated with skipping class more often. Given that substance use can potentially derail a student athlete's academic career, these findings highlight the need to address excessive drinking and marijuana use among this subpopulation of college students. Research has been conducted on athlete-specific, personalized, in-person interventions to reduce substance use with success (Cimini et al., 2015), and implementing programs like these at university student health centers and/or offices where student athletes are treated could bring positive changes. This could allow clinicians to focus their needs and determine important topics of discussion when dealing with this unique population. Because it uncommon for a student to recognize that they might need help to reduce their drinking or quit using substances, it is necessary to disseminate these research findings to athletic personnel to educate them about the nature and consequences of substance use and encourage them to facilitate help-seeking.

Utilizing Data for Training and Technical Assistance for Athletic Personnel

As part of the Maryland Collaborative's technical assistance and training, we utilized these results as the foundation of a training for athletic personnel to address excessive drinking among their athletes. The training incorporates information relevant to both preventing excessive drinking and marijuana use among current non-drinkers/non-users, as well as

intervening to prevent consequences among student athletes who already engage in these substance use behaviors. We present the details of the training here to assist others who might have similar interests in intervening with athletic personnel.

Table 4 summarizes the content of the training, which is a two-hour single-session event that combines elements of a traditional presentation, such as lecturing from a PowerPoint and providing educational materials, to didactic interactive sessions to enhance engagement and learning, as exemplified by the role play activities. A central element of the skill-building portion of the training is to introduce the importance of having "meaningful conversations" with student athletes who might be exhibiting early signs of alcohol- or marijuana-related problems. The skills necessary to have meaningful conversations utilize motivational interviewing principles (Miller & Rollnick, 2012). It is suggested that athletic personnel focus on eliciting self-reflection regarding two types of behaviors. First is the student's drinking or marijuana use. Second is the student's help-seeking behavior. Research tells us that it is very rare for a college student to seek help voluntarily, even if they are experiencing serious consequences related to their drinking (Blanco et al., 2008; Caldeira et al., 2009).

The details in Table 4 provide a model of how the training could be implemented; however, to be most effective, tailoring the training to best fit the wants and needs of an athletic department is essential. For example, some departments might prefer to provide this training only to certain athletic personnel (e.g., only coaches), whereas others might prefer to involve all personnel who have contact with student athletes. The length of the training could also be shortened or expanded depending on time restrictions. Collection of school-specific data on the variables with oversampling of athletes is beneficial to ensure a large enough sample size for meaningful analyses. While the development of the content described herein was guided by the research findings presented in this present paper, the content could be adapted based on findings specific to an individual school. Evaluation of the training is also needed to identify how the training components could be refined to best fit a department's needs.

In summary, the training has two goals: first, to aid athletic personnel in identifying student athletes at risk for or currently experiencing alcohol-related problems, and second, to build and strengthen their communication skills and ability to refer students to on-campus support or intervention. Distribution of materials after the training allows athletic personnel to continue practicing their skills in having meaningful conversations.

Limitations

This study had several limitations that must be noted. First, data on marijuana-related injury was not collected. Previous research has found mixed results for the association between marijuana use and risk for injury (Gmel, Kuendig, Rehm, Schreyer, & Daeppen, 2009; Macdonald et al., 2003); however, we are unable to examine if this association exists among our sample of student athletes. Second, the survey did not assess co-use of alcohol and marijuana. Future research should examine whether alcohol and marijuana co-use have an additive or multiplicative effect on risk for injury. Third, although the sample came from eleven different schools, all of these schools are located in the same state, which could potentially limit the generalizability of the results to other areas of the United States.

Future Directions

These results can be used to inform future interventions with student athletes and athletic personnel to reduce excessive alcohol consumption among student athletes. Interventions and technical assistance with athletic personnel might prove to be more beneficial and have a wider-reaching impact, due to their prominent and unique role, than targeting students alone. The training targeting athletic personnel developed by our team will need to be formally evaluated to determine its effectiveness at reducing excessive drinking and negative consequences of excessive drinking experienced by athletes.

Though progress is being made in addressing problem drinking among the general student population, persistent problems remain within certain high-risk student subgroups, including student athletes. Student athletes are influential members of their campus communities, and maximizing their health and performance is critical to any overall campus alcohol prevention strategy that has an athletic program.

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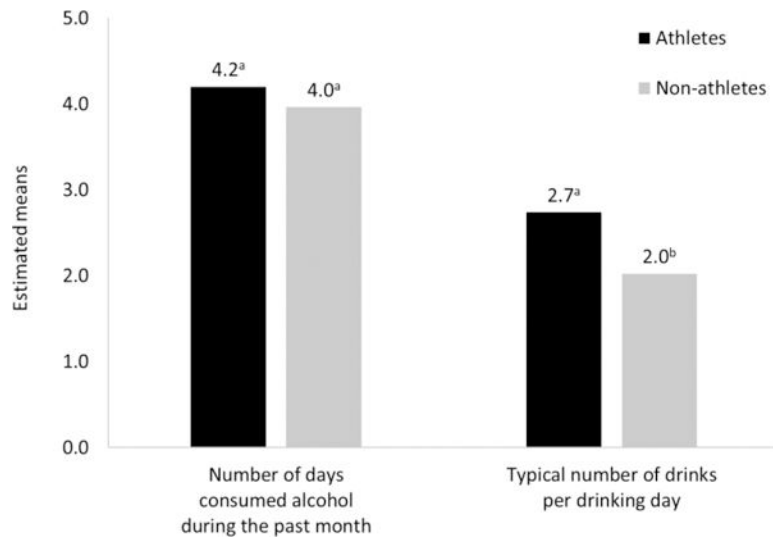
Fig 1a.

Estimated marginal means from linear regression models, controlling for age, sex, race, living situation, and athlete status. *Note.* Bars within the alcohol risk group or within marijuana use not sharing the same superscripted letter are significantly different than each other at $p < .05$.

Fig 1b.

Estimated marginal means from logistic regression models, controlling for age, sex, race, living situation, and athlete status. *Note.* Bars within the alcohol risk group or within marijuana use not sharing the same superscripted letter are significantly different than each other at $p<.05$.
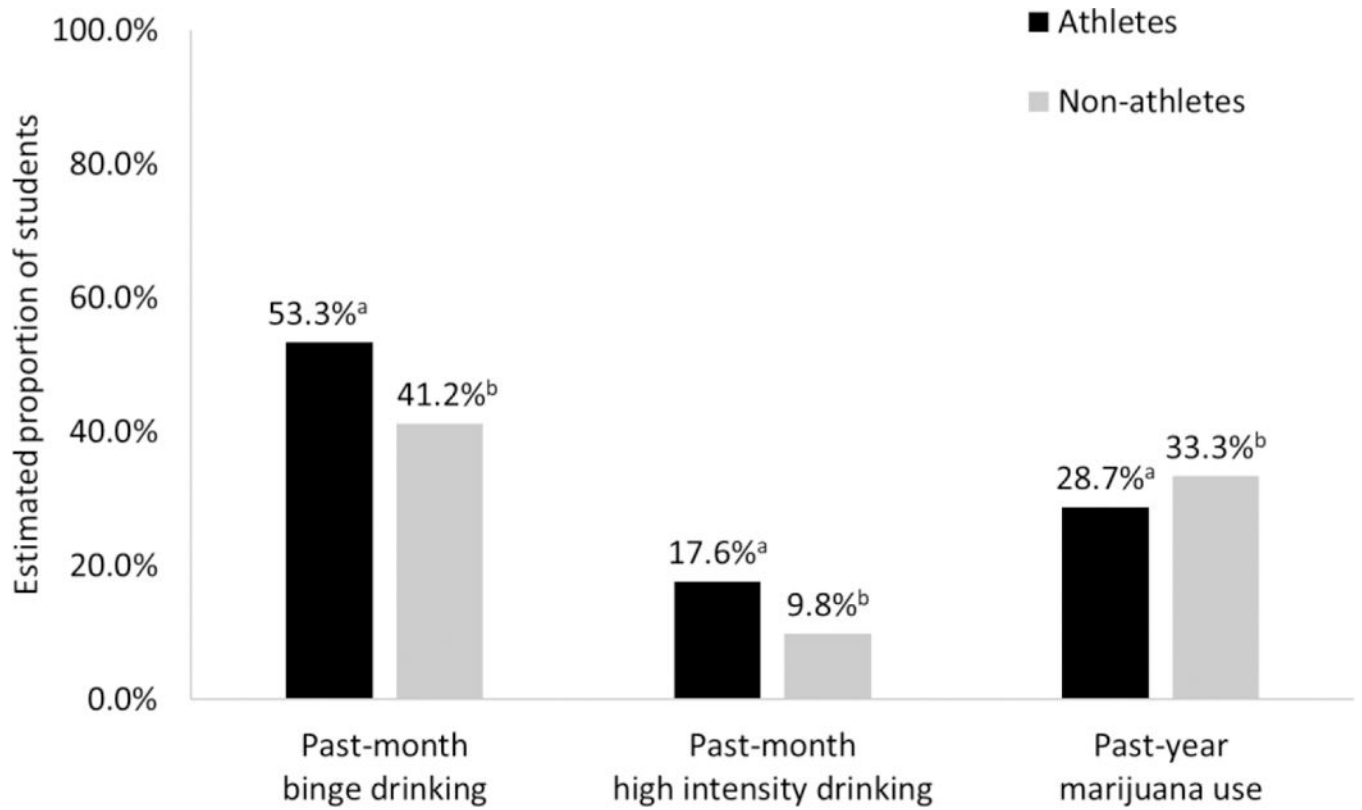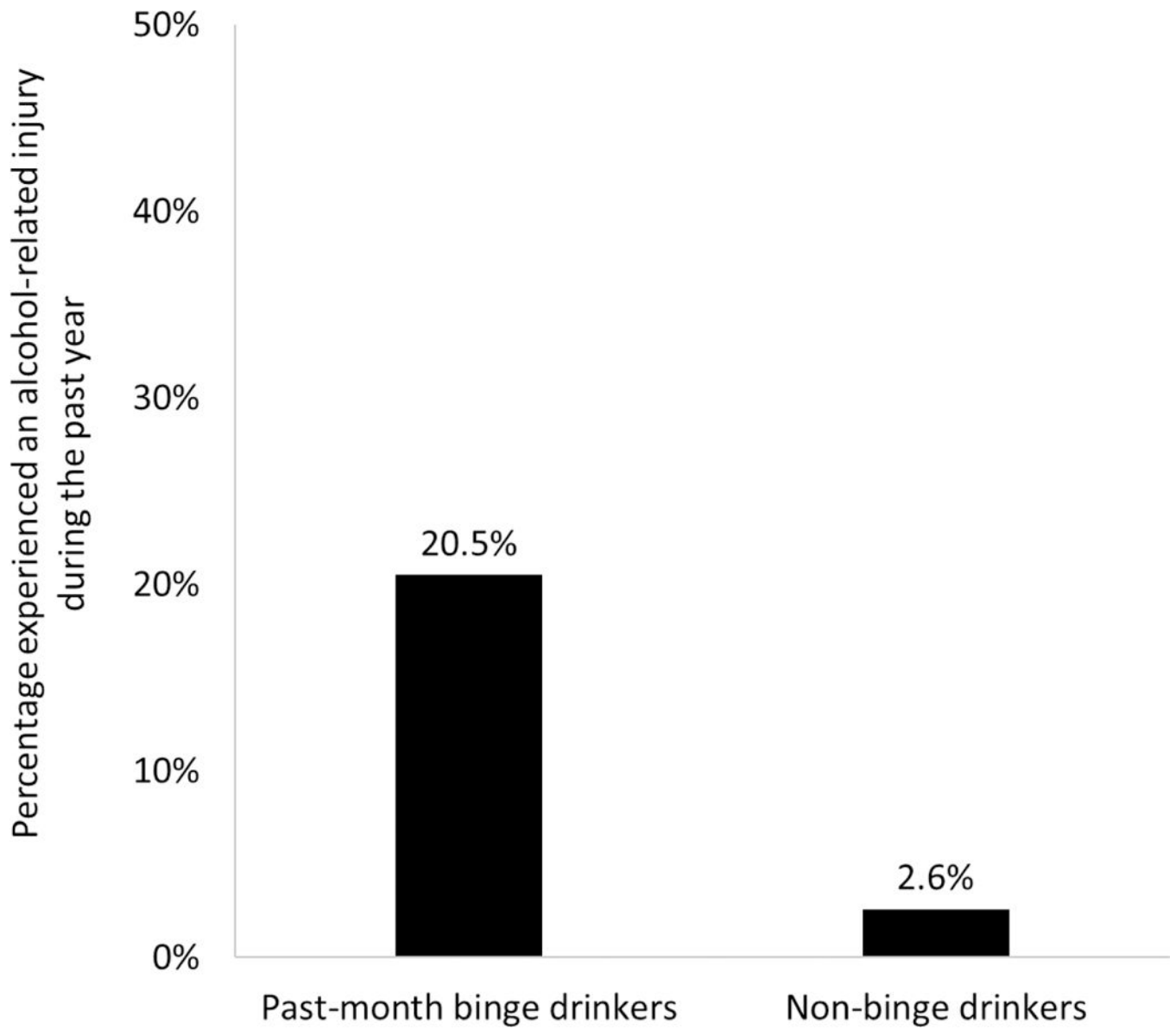
Fig 2.
Percentage of student athletes who experienced an alcohol-related injury during the past year, by past-month binge drinking. *Note.* Past-month binge drinkers and non-binge drinkers are significantly different than each other at *p*<.05.

Fig 3a.

Cumulative GPA, by student athletes' past-month binge drinking and past-year marijuana use. *Note.* Bars within the alcohol risk group or within marijuana use not sharing the same superscripted letter are significantly different than each other at $p < .05$.

Fig 3b.

Prevalence of skipping class, by student athletes' past-month binge drinking and past-year marijuana use. *Note.* Bars within the alcohol risk group or within marijuana use not sharing the same superscripted letter are significantly different than each other at $p<.05$
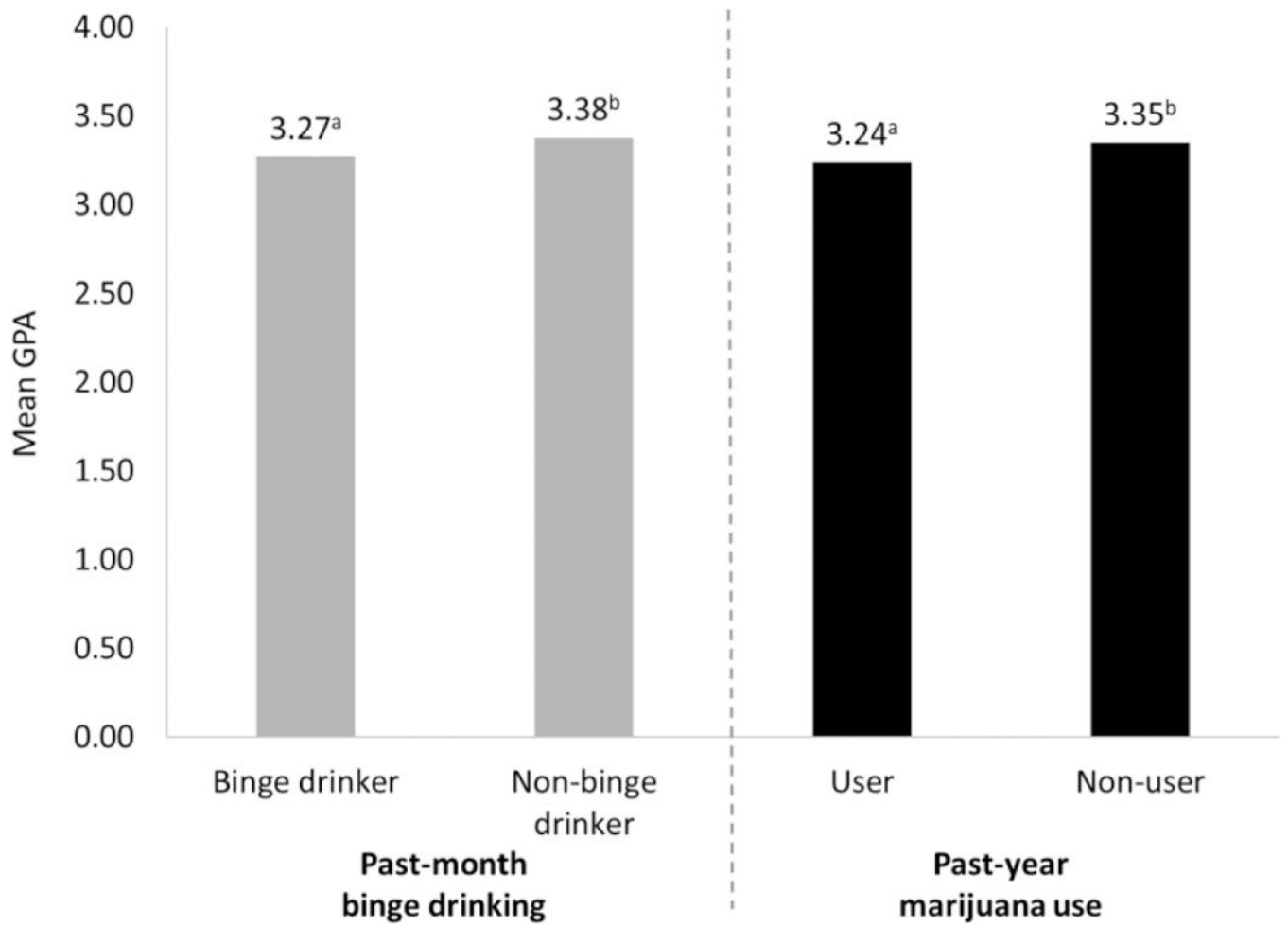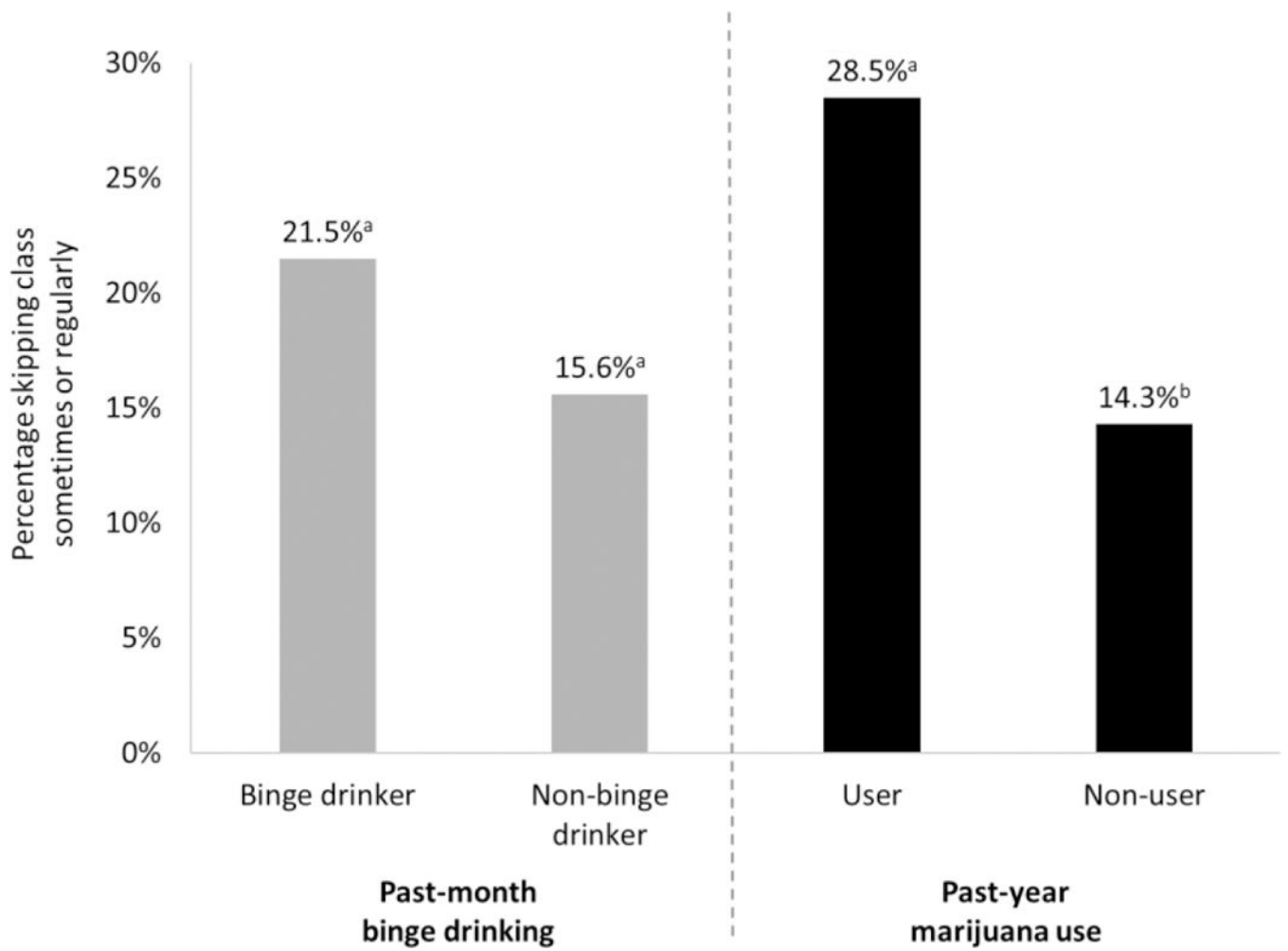
Table 1

Sample Characteristics and Alcohol Consumption by Student Athlete Status

| | Overall N=12,510 | | Student athlete status | | | |
| | | | Athlete n=1,233 | | Non-Athlete n=11,277 | |
	n	*%*	*n*	*%*	*n*	*%*
Age (% under 21) [*]	7,837	62.6	873	70.8	6,964	61.8
Sex (% male) [*]	4,173	33.4	493	40.0	3,680	32.7
Race/ethnicity						
White, non-Hispanic [*]	6,814	54.9	822	67.2	6,992	53.6
Black or African American, non-Hispanic [*]	2,205	17.8	144	11.8	2,061	18.4
Asian, non-Hispanic [*]	1,609	13.0	79	6.5	1,530	13.7
Hispanic	958	7.7	79	6.5	879	7.9
Two or more races [*]	623	5.0	77	6.3	546	4.9
Other	200	1.6	23	1.9	177	1.6
Living situation						
Residence hall [*]	5,997	47.9	698	56.6	5,299	47.0
Non-school owned house or apartment	2,659	21.3	239	19.4	2,420	21.5
School-owned apartment [*]	1,948	15.6	227	18.4	1,721	15.3
Parent or guardian's home [*]	1,708	13.7	46	3.7	1,662	14.7
Other	197	1.6	23	1.9	174	1.5
Year in school						
First year	4,358	35.1	437	35.5	3,921	35.0
Sophomore	3,306	26.6	331	26.9	2,975	26.6
Junior	2,620	21.1	255	20.7	2,365	21.1
Senior	2,144	17.3	208	16.9	1,936	17.3
Marijuana use (% used during past year)	2,666	34.1	259	33.0	2,407	34.2
Alcohol consumption						
% drank alcohol during past year [*]	9,843	78.7	1,062	86.1	8,781	77.9
% binge drank during past month [*]	5,526	44.5	714	58.5	4,812	42.9
% high intensity drinking during past month [*]	1,543	12.4	276	22.6	1,267	11.3
	M	SD	M	SD	M	SD
Past-month frequency [*,**]	4.4	5.5	4.9	5.5	4.4	5.5
Typical number of drinks per drinking day [*,**]	2.3	2.7	3.4	3.4	2.2	2.6

[*] Differences between athletes and non-athletes significant at p<.05.

[**] Participants who did not drink during the past month were coded as 0 for both past-month frequency and typical number of drinks per drinking day.

Table 2

Results of Linear Regression Models Predicting Alcohol Consumption among Athletes and Non-athletes

	Past-month alcohol consumption frequency	Typical number of drinks per drinking day
	AOR (95% CI)	AOR (95% CI)
Age	1.141 (1.123 – 1.160) [**]	1.032 (1.014 – 1.050) [**]
Sex (Ref=Male)	0.799 (0.766 – 0.834) [**]	0.698 (0.667 – 0.730) [**]
Race (Ref=Non-Hispanic white)		
Non-Hispanic black or African American	0.627 (0.592 – 0.664) [**]	0.580 (0.545 – 0.617) [**]
Non-Hispanic Asian or Pacific Islander	0.533 (0.499 – 0.571) [**]	0.621 (0.579 – 0.666) [**]
Hispanic	0.925 (0.857 – 0.999) [*]	0.973 (0.897 – 1.055)
Two or more races	0.882 (0.803 – 0.969) [**]	0.843 (0.763 – 0.932) [**]
Other	0.671 (0.566 – 0.795) [**]	0.644 (0.537 – 0.772) [**]
Living situation (Ref=Residence hall)		
Non-school owned apartment or house	1.365 (1.287 – 1.447) [**]	1.267 (1.190 – 1.348) [**]
School-owned apartment	1.391 (1.309 – 1.478) [**]	1.221 (1.144 – 1.303) [**]
Parent or guardian's home	0.669 (0.621 – 0.720) [**]	0.600 (0.555 – 0.648) [**]
Other	1.633 (1.396 – 1.909) [**]	1.249 (1.055 – 1.478) [**]
Athlete status (Ref=Non-athlete)	1.060 (0.991 – 1.134)	1.352 (1.261 – 1.449) [**]

[*] p<.05

[**] p<.01

Note. Participants who did not drink during the past month were coded as 0 for both past-month frequency and typical number of drinks per drinking day.

Table 3

Results of Logistic Regression Models Predicting Alcohol and Marijuana Use among Athletes and Non-athletes

	Past-month binge drinking AOR (95% CI)	Past-month high intensity drinking AOR (95% CI)	Past-year marijuana use AOR (95% CI)
Age	1.097 (1.063 – 1.132)**	1.015 (0.969 – 1.063)	0.979 (0.943 – 1.016)
Sex (Ref=Male)	0.816 (0.749 – 0.890)**	0.216 (0.191 – 0.244)**	0.897 (0.808 – 0.995)*
Race (Ref=Non-Hispanic white)			
Non-Hispanic black or African American	0.415 (0.370 – 0.466)**	0.285 (0.229 – 0.355)**	0.882 (0.772 – 1.008)
Non-Hispanic Asian or Pacific Islander	0.424 (0.371 – 0.485)**	0.362 (0.288 – 0.456)**	0.458 (0.385 – 0.544)**
Hispanic	0.976 (0.837 – 1.138)	0.957 (0.775 – 1.182)	1.351 (1.137 – 1.605)**
Two or more races	0.714 (0.592 – 0.861)**	0.687 (0.518 – 0.910)**	1.173 (0.954 – 1.441)
Other	0.526 (0.376 – 0.735)**	0.398 (0.228 – 0.695)**	0.810 (0.573 – 1.146)
Living situation (Ref=Residence hall)			
Non-school owned apartment or house	1.688 (1.499 – 1.900)**	1.941 (1.643 – 2.292)**	1.355 (1.179 – 1.557)**
School-owned apartment	1.619 (1.431 – 1.832)**	1.625 (1.360 – 1.941)**	1.246 (1.065 – 1.457)**
Parent or guardian's home	0.439 (0.379 – 0.508)**	0.579 (0.453 – 0.741)**	0.442 (0.369 – 0.529)**
Other	1.717 (1.237 – 2.383)**	2.530 (1.720 – 3.720)**	1.043 (0.703 – 1.546)
Athlete status (Ref=Non-athlete)	1.633 (1.432 – 1.875)**	1.953 (1.654 – 2.306)**	0.807 (0.685 – 0.950)*

*
$p<.05$

**
$p<.01$

Table 4

Outline of Training for Athletic Personnel

Topic Area	Instructional Format	Time	Instructional Details
1. Introduction to Terminology and National Data	PowerPoint presentation	5 minutes	Present information from the literature on binge drinking, high intensity drinking, high-risk drinking patterns, and marijuana use.
2. Excessive Drinking and Marijuana Use among College Athletes	PowerPoint presentation	15 minutes	Present school-specific data on prevalence, frequency, and harms of alcohol and marijuana use among college athletes and in comparison with non-athletes.
3. Risk for Alcohol-related Injury among Athletes	PowerPoint presentation	10 minutes	Present research findings and school-specific data on negative consequences experienced by college athletes associated with alcohol consumption with particular emphasis on injury.
4. Risk for Academic Difficulties Associated with Excessive Drinking and Marijuana Use	PowerPoint presentation	10 minutes	Present school-specific data on negative consequences experienced by college athletes associated with alcohol and marijuana use, with particular emphasis on academic difficulties.
5. Importance of MI-based Meaningful Conversations	Trainer-led demonstration of MI principles, video presentation	25 minutes	Introduce principles of motivational interviewing (MI). Emphasize the utility of "meaningful conversations" based on MI to encourage behavior change and facilitate help-seeking.
6. Practicing Skills for Having Meaningful Conversations	Role play scenarios, discussion	35 minutes	Present common athlete-specific scenarios and allow the audience time to role play meaningful conversations. The scenarios involve situations like an athlete showing up to practice hungover and an underage athlete drinking at a party that was shut down by police. Discussion is focused on what went well and what challenges they encountered during role play.
7. Q&A Session	Open discussion	20 minutes	Allow the audience the opportunity to have their questions answered by the presenters and/or other athletic personnel.
	Total:	2 hours	