Secondary effects of *myPlaybook* on college athletes' avoidance of drinking games or pregaming as a protective behavior strategy: A multisite randomized controlled study

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Abstract:

Rationale: Student-athletes are at risk for engaging in drinking games and pregaming. Research suggests that brief motivational and alcohol education intervention approaches designed to reduce harmful drinking behaviors may not be effective in lowering students' participation in drinking games or pregaming. **Method:** We evaluated the effects of *myPlaybook* (a student-athlete-specific web-based alcohol intervention) on student-athletes' avoidance of drinking games and pregaming over a 4-month period. Seventy-three NCAA member institutions were randomly assigned to the treatment condition or a no-intervention control. Student-athletes at these schools (N = 2449) completed assessments at baseline, 1-, and 4-months post-intervention. At each assessment, participants indicated how often they used each of several harm prevention strategies when they drank in the past month including "avoided drinking games" and "avoided drinking before going out (i.e., pregaming or pre-drinking)." **Results:** Controlling for gender and race/ethnicity, treatment condition was not associated with change in avoidance of drinking games and pregaming between baseline and either follow-up. Athletic season did not moderate treatment effects on avoidance of either behavior. We found no evidence that *myPlaybook*, a general alcohol-reduction intervention, is efficacious in influencing student-athletes' avoidance of drinking games or pregaming as a protective strategy. **Conclusions:** Findings from the present study as well as other research suggest that general alcohol-focused interventions may not have secondary effects on reducing students' participation in drinking games and pregaming and as such, more specific targeted interventions should be investigated.

Keywords: Drinking games | Pregaming | Pre-drinking | Prepartying | Alcohol | Athletes | Intervention

Article:

1. Introduction

Research robustly indicates that student-athletes consume higher amounts of alcohol and experience more harm from alcohol use than non student-athletes (Diehl et al., 2012; Kwan et al., 2014; Lisha and Sussman, 2010; Zhou and Heim, 2014). For example, in a recent study, Mastroleo et al. (2018) found that compared to non student-athletes, a higher proportion of student-athletes reported heavy episodic drinking (47.9% versus 62.2%, respectively) and negative sex-related drinking consequences (13.1% versus 21.9%, respectively). The student-athletes in their sample also had higher peak estimated breath alcohol concentrations (0.123) than non student-athletes (0.098). Social norms around alcohol use may also influence student-athletes' personal drinking behaviors in a way that differs from non student-athletes. For example, Dams-O'Connor et al. (2007) noted that the perceived consumption behavior of proximal groups (e.g., close friends) is a stronger predictor of individual consumption than perceived consumption behavior of more distal groups (e.g., typical student at one's university) (Baer et al., 1991). Among student-athletes, however, they found that the strongest predictors of personal alcohol use were perceived norms of the typical student-athlete, followed by the typical student non-athlete (during the off-season only). They surmised that this may reflect the greater influence of distal (versus proximal) groups among the student-athletes in their sample. In short, there is evidence suggestive that student-athletes differ from non student-athletes when it comes to their drinking behaviors, risk for negative drinking consequences, and to some extent, perceived norms around alcohol use. Thus, continued alcohol research and intervention efforts among student-athletes are needed.

1.1. Drinking games

A drinking game (DG) is a social drinking activity that requires participants to perform a mental and/or motor task and consists of rules designed to get players drunk (Zamboanga et al., 2013a, Zamboanga et al., 2013b). Participation in DGs can contribute to college students' and student-athletes' risk for heavy alcohol consumption and negative alcohol-related outcomes (Grossbard et al., 2007; Hummer et al., 2011; Jones, 2015; Zamboanga et al., 2008; for reviews, see Kenney et al., 2017; Zamboanga et al., 2014). Although DG participation has been linked to a number of problematic health outcomes (e.g., blackouts, sexual victimization/perpetration; Zamboanga et al., 2014), young adults' awareness of the health hazards associated with heavy drinking does not seem to influence their decision to participate (Polizzotto et al., 2007). Indeed, Grossbard et al. (2007) found that almost half of the students in their samples reported having played a DG at least once in the past year.

There is also evidence to suggest that compared to non-athletes, student-athletes are at greater risk for DGs participation. Grossbard et al. (2007) found that both intramural and intercollegiate student-athletes played DGs more often than non-athletes. There are several possible explanations for this finding. First, for many student-athletes, being an athlete is an important part of their personal identity (Brewer et al., 1993; Lisha and Sussman, 2010). Because the sports team culture promotes social cohesion among teammates (Zhou and Heim, 2014), DGs can serve as a social vehicle that facilitates camaraderie (Hummer et al., 2011). Second, student-athletes are accustomed to competing against opponents and their teammates, raising the possibility that their competitive tendencies can manifest in social drinking activities (Martens, 2012; Martens et al., 2006), and even increase their risk for higher alcohol consumption (Serrao et al., 2008). Competitive DGs (e.g., beer pong) may therefore appeal to many student-athletes. Finally, heavy

drinking among student-athletes may stem from a work hard-play hard athletic lifestyle; student-athletes may play DGs to celebrate the hard work associated with being a student-athlete or as a way to facilitate rapid consumption during the few opportunities they have to drink in light of their time-consuming athletic commitments (Hummer et al., 2011; Martens et al., 2006).

1.2. Pregaming/prepartying

Another prevalent risky drinking behavior that can contribute to heavy drinking and adverse alcohol-related health consequences among college students is pregaming/prepartying (i.e., drinking alone or with others before attending an event or gathering where more alcohol consumption may take place; Zamboanga and Olthuis, 2016). Pregaming has been linked to heavy alcohol use and negative drinking consequences (Foster and Ferguson, 2014; Zamboanga et al., 2013a, Zamboanga et al., 2013b). To our knowledge, only two studies have examined pregaming among college student-athletes. Mastroleo et al. (2018) found that pregaming is more prevalent and practiced more frequently among student-athletes compared to non student-athletes. Hummer et al. (2011) found that over 60% of Division I student-athletes report past month pregaming. Their findings also indicate that compared to student-athletes who did not pregame or did not play DGs while pregaming, those who play DGs while pregaming consume more alcohol, experience more negative drinking consequences, and endorse more positive reinforcement reasons for drinking (e.g., “Because I work so hard at my sport, I should be able to drink to have a good time”). Given the importance of social cohesion among athletes (Zhou and Heim, 2014) and the work hard-play hard athletic lifestyle (Hummer et al., 2011; Martens et al., 2006), student-athletes may be motivated to pregame to enhance social experiences (e.g., to pump oneself up before going out) and/or to have fun and get intoxicated quickly (Bachrach et al., 2012; LaBrie et al., 2012).

1.3. Intervention studies on drinking games and pregaming

The efficacy of alcohol-education focused programs (e.g., *AlcoholEdu*, *Alcohol 101*, *Alcohol-Wise*) and brief motivational interventions (BMIs) that are designed to help lower college students' risk for heavy alcohol use and negative drinking consequences are well documented in the literature (Cronce and Larimer, 2014; Martens, 2012; Tanner-Smith and Lipsey, 2015). However, questions about their effectiveness in reducing students' participation in practices that facilitate heavy drinking, like playing DGs or pregaming, have recently been raised (Borsari et al., 2016; Fernandez et al., 2017). Our understanding of how well these interventions work to reduce students’ engagement in DGs and pregaming is limited.

We know of five college intervention studies that reported on DGs or pregaming behaviors as an outcome. In the first study, Croom et al. (2009) found that a significantly lower proportion of college freshmen who received *AlcoholEdu* reported playing DGs compared to students in a no-intervention control condition (33% vs. 39%). In the second study, Wood et al. (2010) found that students who received a BMI compared to those who did not were less likely to play DGs over their first two years of college. In the third study, Croom et al. (2015) found that a significantly lower percentage of incoming freshmen who received *Alcohol-Wise* reported playing DGs relative to those receiving no intervention at one university (42% vs. 46%) but not a second (47% vs. 48%). In the fourth study, Fernandez et al. (2017) evaluated the effects of intervention

on DGs in two separate trials with mandated students. Trial 1 compared BMI to a single-session psychoeducation intervention (*Alcohol 101 Plus*) and Trial 2 compared BMI to an assessment-only control condition. There were no effects of treatment condition on DG participation in either trial. Finally, using the same sample from Trial 2 of the Fernandez et al. paper (BMI vs. assessment only), Borsari et al. (2016) also found no treatment effect on pregaming frequency, even when pregaming was discussed during the intervention. The mixed findings reported in these studies warrant further examination of the efficacy of existing intervention strategies in reducing students' participation in risky drinking practices like DGs or pregaming. Given that student-athletes are at greater risk for heavy alcohol consumption and negative drinking consequences than non student-athletes, it is important that researchers focus on this population.

2. Current study

2.1. Intervention: *myPlaybook*

We examined student-athlete data from a large multisite randomized controlled trial (RCT) of *myPlaybook* (see Wyrick et al., 2014), a web-based alcohol intervention program created specifically for National Collegiate Athletic Association (NCAA) college student-athletes to reduce their risk for harmful drinking behaviors and related negative consequences. *myPlaybook* is a web-based, multicomponent skills-building intervention focused on the prevention of substance use by targeting risk and protective factors associated with risky drinking and related negative consequences. Using an online learning management system, *myPlaybook* targets social norms, alcohol expectancies, and alcohol-related protective behavioral strategies. The primary goal of *myPlaybook* is to decrease alcohol use among collegiate student-athletes by way of these three mediators (Fearnow-Kenney et al., 2016) and behavioral intentions to prevent harm. Because *myPlaybook* was designed specifically for NCAA student-athletes, there is also an intro lesson that provides standardized education related to the NCAA's banned substances and drug testing policies and procedures. While a variety of protective behavioral strategies such as avoiding DGs and pregaming were noted in the intervention, they were not specifically targeted at length.

myPlaybook is composed of three lessons, each of which takes an average of 12-min to complete, and is administered through a variety of instructional design tools/strategies (e.g., personalized feedback activities, quizzes, and interactive flash animations). These lessons contain content that is in line with five behavior change techniques (Michie et al., 2013): natural consequences, feedback and monitoring, comparison of behavior, comparison of outcomes, and shaping knowledge. For example, student-athletes assigned to the intervention arm received a Norms lesson that provided data related to *information about others' approval* and *social comparison* (comparison of behavior). Specifically, there are interactive activities designed to challenge student-athlete misconceptions of the prevalence and acceptance of heavy drinking among their peers. Student-athletes also receive personalized *feedback on behavior* (feedback and monitoring) comparing their own alcohol use to that of the average national student-athlete. The Expectations lesson provides learning activities that guide student-athletes through a critical exploration of their beliefs about alcohol-related *health consequences* (natural consequences); students then receive personalized feedback with accurate information that helps them reevaluate

their positive and negative alcohol expectancies. Finally, the Harm Prevention lesson encourages student-athletes to consider the *pros and cons* (comparison of outcomes) of using harm prevention strategies and provides *instruction on how to perform a behavior* (shaping knowledge; e.g., protective behavioral strategies designed to limit the amount of alcohol consumed) (see the online supplement for examples of the intervention interface/instructional design).

2.2. Research aims and hypotheses

A recent unpublished grant report (NIDA: DA023735) indicates that *myPlaybook* had a small but statistically significant effect on reducing frequency of alcohol use, as well as alcohol and other drug related consequences (e.g., drove a car while under the influence) for in-season student-athletes from baseline to 30-days post-intervention but not 4-months post-intervention. No intervention effects for frequency of binge drinking were found. Thus, in the context of the intervention's small, short-term effect on student-athletes' frequency of drinking and their experiences with negative alcohol and other drug related outcomes, we were interested in evaluating the effect of *myPlaybook* on change in student-athletes' avoidance of DGs and pregaming during the last 30 days at 1-month and 4-months post-intervention, as compared to a no-intervention control. Even though engagement in DGs and pregaming is not the primary focus of the intervention, we theorized that students would extrapolate what they learn about drinking to their own drinking behaviors, which is akin to a test of student-athletes' ability to apply knowledge to related situations. Given that, as a part of *myPlaybook*, student-athletes (a) considered the pros and cons of using protective behavioral strategies such as avoiding DGs and pregaming, and (b) were provided instructions on how to perform other strategies designed to limit the amount of alcohol consumed, examination of the indirect impact of the intervention on students' involvement in DGs and pregaming is warranted. We expected that avoidance of DGs and pregaming would increase from baseline to follow-up assessments more in the intervention versus the control group. In other words, student-athletes receiving *myPlaybook*, which focused on facilitating use of harm-reduction strategies, would be more likely to avoid playing DGs or pregaming, as two specific examples of harm reduction strategies. We also explored athletic season at each assessment as a time-varying moderator of the hypothesized associations, as student-athletes tend to drink more during the off-season (Mastroleo et al., 2018; Zhou and Heim, 2014). Research shows gender differences in alcohol intervention responding (Carey et al., 2009), pregaming behaviors (Hummer et al., 2011), and to some extent, DGs participation (Zamboanga et al., 2014). Furthermore, research shows racial/ethnic differences in drinking behaviors and alcohol-related problems among student-athletes (Doumas and Midgett, 2015; Mastroleo et al., 2018; Turrisi et al., 2006). As such, the impact of *myPlaybook* on avoidance of DGs and pregaming was examined while controlling for these demographic variables.

3. Method

3.1. Participants

Participants were 2449 National Collegiate Athletic Association (NCAA) Division I, II, and III first-year and transfer student-athlete drinkers from 73 NCAA member institutions. The NCAA is an organization that governs much of U.S. collegiate sports (e.g., makes rules and policies

surrounding college sports, runs championships, and manages programs to support student-athletes). It is a member-led organization whose goal is to promote the academic, health, and long-term personal and professional success of student-athletes (see www.ncaa.org). NCAA member schools provide academic (e.g., access to tutors/academic advisers), financial (e.g., athletic scholarships), wellness (e.g., training on concussions, substance use), and professional (e.g., leadership development) support for student-athletes. *myPlaybook* was designed for first-year and transfer student-athletes because (a) first-year college students are a high-risk group for heavy alcohol use and negative drinking consequences, and (b) first-year student-athletes are less likely than veteran student-athletes to have been previously exposed to sport-related drug and alcohol prevention efforts (NCAA, 2014). NCAA member institutions were invited to participate via relevant listservs and manually populated NCAA contact lists (e.g., senior administrators). Email invitations were also sent to institutions that had participated in a prior larger study on the development of *myPlaybook*. All first-year and transfer student-athletes 18 years of age or older at the participating schools were eligible to participate.

3.2. Procedures

One hundred thirty-one schools indicated initial interest in participating; of these schools, 73 (55.7%) agreed to participate. Schools were randomly assigned to the treatment (38 schools; 4548 student-athletes) or control (35 schools; 4082 student-athletes) condition. Prior to randomization, schools were stratified by athletic division (i.e., Division I, II, or III). Subsequently, a randomized block design was used whereby students within the same school were assigned to the same condition, and separate randomization sequences were generated within division. Randomization sequences were generated within R statistical computing software.

The fall semester was selected for intervention implementation because it is an optimal time to deliver alcohol and other drug prevention programming to student-athletes who are new to the university. All eligible first-year and transfer student-athletes from each participating school were sent an email on September 15, 2014 that included study information, instructions to complete *myPlaybook*, and a link to the web-based baseline survey administered via *SurveyMonkey*. Of the 8,630 first-year and transfer student-athletes who received the invitation, 5,860 completed the baseline survey (67.9%), and of these, 3,370 (57.5%) completed the 1-month follow-up, and 2,317 (39.5%) completed the 4-month follow-up. As such, our data set started with 5,860 participants but given that our study focused on past 30-day avoidance of DGs and pregaming as a protective behavior strategy, we restricted the data analyses to only those who reported past 30-day alcohol use at baseline ($n = 2,467$). In addition, we were not able to include participants who (a) did not report their gender ($n = 8$) or race/ethnicity ($n = 5$) at baseline or (b) had no repeated measure data on avoidance of DGs and pregaming ($n = 5$). The final data analytic sample for the present study is 2,449.

Student-athletes were able to complete the baseline survey and intervention between September 15, 2014 and October 10, 2014, the 1-month assessment between October 10, 2014 and December 4, 2014, and the 4-month assessment between February 12, 2015 and March 16, 2015. The project director delivered email reminders to student-athletes 1–2 times per week (on average). To improve participation, the investigators used multiple levels of incentives (all

incentives received by athletic departments, not by student-athletes) including providing program access for free, rewarding high rates of baseline assessment completion with a school-specific evaluation report, and providing a series of opportunities to win $1000 based on high rates of assessment completion. To facilitate accurate reporting of substance use behaviors, the investigators informed student-athletes that their responses in the *myPlaybook* program and surveys would be confidential, and that they could voluntarily withdraw from the study at any time. All participants provided informed consent prior to the baseline assessment. The principal investigator's (Dr. David L. Wyrick) institutional review board at the University of North Carolina-Greensboro approved study protocols.

3.3. Measures

At baseline, participants reported age, racial/ethnic background, gender, and athletic division. At each assessment, participants indicated how often they used each of several protective strategies when they drank in the past 30 days. These included "avoided drinking games" and "avoided drinking before going out (i.e., pregaming)"; response options for these questions included 0 = *never*, 1 = *less than half the time*, 2 = *about half the time*, 3 = *more than half the time*, and 4 = *always* (range at baseline = 0 through 4 for both DG and pregaming). Participants also reported how often they used alcohol in the past 30 days: 0 = *never*, 1 = *once*, 2 = *twice*, 3 = *3–5 times*, 4 = *6–9 times*, and 5 = *10 + times* (range at baseline = 1 through 5). Finally, participants indicated if their sport was "in season (currently competing)" or "off season (not currently competing)."

3.3.1. Control

To improve partner relations and to ensure that all student-athletes received some education during the study, student-athletes who were randomly assigned to the control condition received access to *myPlaybook's* introductory lesson only. Once all data collection was complete, all *myPlaybook* lessons were made available to control participants.

3.4. Data analysis plan

Out of 7347 possible observations ($N = 2449$ participants × 3 assessments), data were missing from a total of 2532 assessments (34%). Missing assessment data were imputed with multiple imputation using chained equations (Azur et al., 2011). We imputed ten datasets over ten iterations using the *mice* package in R (van Buuren and Groothuis-Oudshoorn, 2011) and included covariates, outcome variables, and predictors of missingness in the imputation. We bounded imputed values for avoidance of DGs and pregaming at each iteration to the possible range of these measures (i.e., 0 through 4). We evaluated imputed means and standard deviations across iterations and datasets to ensure convergence, and examined distributional densities to assess the consistency of imputed and observed data. We report pooled parameter estimates in all multilevel models (Rubin, 1987).

We used the *lme4* package in R (Bates et al., 2015) to conduct hierarchical linear modeling (HLM), given the multilevel nature of the data (measures over time nested within participants). Both outcomes (past 30 day avoidance of DGs and pregaming) were normally distributed. We

ran fully unconditional HLM models (i.e., no predictors) first, in order to determine the proportion of variation in each outcome at the between-person level (intraclass correlations, ICCs). We initially examined a 3 level model (time at Level 1 nested within participants at Level 2 nested within school at Level 3). However, the proportion of variability in our outcomes attributable to school in a 3 level framework was negligible (<4%), suggesting that a two level model was adequate. In primary models, two time components (Time1M coded 0, 1, 0; Time4M coded 0, 0, 1) at Level 1 (within-person level) represent change from baseline to 1-month (1MFU) and 4-month (4MFU) follow-ups, respectively. We estimated random intercepts for observations clustered within individuals. For each outcome, we added condition at Level 2 (between-person level) as a predictor of the intercept (i.e., effect of group on the outcome at baseline) and both time effects (i.e., effect of group on change in the outcome between baseline and 1MFU and between baseline and 4MFU). Gender and race/ethnicity (coded as white versus non-white) were also modeled at Level 2 as time-invariant predictors of intercept and slope effects, in order to control for the potential impact of these variables on any changes in outcomes over time. Further, frequency of drinking was included as a Level 1 (time-varying) covariate. In a subsequent set of exploratory models, we examined athletic season (in- versus off-season at each assessment) as a Level 1, time-varying moderator of the effect of *myPlaybook* on the outcomes.

4. Results

Table 1. Sample descriptives by group.

Baseline Variables	**Full Sample *M* (*SD*) or *N* (valid %)**	**Intervention *M* (*SD*) (*n* = 1305)**	**Control *M* (*SD*) (*n* = 1144)**	**Group Difference Tests**
Female	1003 (41%)	499 (38.2%)	504 (44.1%)	χ^2 (1) = 8.53, $p < .01$
Age	18.84 (1.29)	18.81 (1.25)	18.88 (1.34)	t (2416) = 1.37, $p = .17$
Race/Ethnicity				χ^2 (5) = 18.49, $p < .01$
White	1806 (73.7%)	998 (76.5%)	808 (70.6%)	
Black	226 (9.2%)	106 (8.1%)	120 (10.5%)	
Asian/Hawaiian/PI	32 (1.3%)	19 (1.5%)	13 (1.1%)	
American Indian/Alaskan Native	12 (<0.5%)	6 (0.5%)	6 (0.5%)	
Hispanic[a]	250 (10.2%)	107 (8.2%)	143 (12.5%)	
Multiracial	123 (5.0%)	69 (5.3%)	54 (4.7%)	
Avoidance of Drinking Games	2.72 (1.42)	2.73 (1.42)	2.71 (1.43)	t (2419) = -0.38, $p = .71$
Avoidance of Pregaming	2.80 (1.45)	2.80 (1.47)	2.80 (1.43)	t (2437) = 0.09, $p = .93$
Baseline Frequency of Drinking	2.48 (1.14)	2.53 (1.14)	2.42 (1.12)	t (2447) = -2.28, $p = .02$
Athletic Season (In-Season)	**Baseline**	**1-Month**	**4-Months**	
n (valid %)	1131(46.6%)	454 (32.3%)	672 (60.5%)	

Note. Frequency of drinking (past month) coded as 0 = never, 1 = once, 2 = twice, 3 = 3–5 times, 4 = 6–9 times, and 5 = 10 + times. As such, baseline frequency of drinking averaged between 2 and 5 times per month.
[a] Includes biracial Hispanic participants.

4.1. Preliminary analyses

4.1.1. Sample characteristics

Participants were 41% female (*M* age = 18.8; *SD* = 1.29; 74% white), and 25% Division I, 61% Division II, and 14% Division III student-athletes. Baseline descriptives by group are presented in Table 1. Examination of potential covariates revealed that groups did not differ at baseline on

age or any of the outcomes. However, there were significant baseline differences in drinking frequency, gender, and racial/ethnic background (Table 1); thus, we controlled for these variables in all models. ICCs were 0.48 and 0.51 for avoidance of DG and avoidance of pregaming, respectively.

4.1.2. Intervention delivery

Most people in the treatment group (83%) completed all 4 *myPlaybook* lessons, 2% completed three, 3% completed two, 4% completed one lesson, and 8% did not complete any lessons. All participants who were supposed to receive the intervention were included in the analyses (i.e., intent-to-treat), as this is best practice.

4.1.3. Assessment completion

The average number of assessments completed, including baseline, was 1.97 ($SD = 0.85$); 37% of the sample completed one, 28% completed two, and 34% completed all three. The number of assessments completed was not significantly related to either of the outcomes. We assumed that these data were missing at random (MAR), but they were not missing completely at random (MCAR) as there were significant (though very small) associations between fewer assessments completed and assignment to treatment condition ($r = -0.09$, $p < .01$), being male ($r = 0.13$, $p < .01$), older age ($r = -0.10$, $p < .01$), and higher baseline frequency of drinking ($r = 0.04$, $p < .05$). Additionally, being white was associated with completion of a greater number of assessments ($\chi^2 = 33.77$, $p < .01$). As such, these variables were included in the multiple imputation procedure and/or as model covariates.

Table 2. Multilevel model results of effects of treatment on avoidance of drinking games and avoidance of pregaming.

Time period and variables	**Avoidance of Drinking Games**				**Avoidance of Pregaming**			
	B	***SE***	***t***	***p***	***B***	***SE***	***t***	***p***
Frequency of drinking	−0.13	0.01	−13.60	<.001	−0.15	0.01	−15.27	<.001
Intercept (baseline level)	3.06	0.06	48.93	<.001	3.29	0.06	52.22	<.001
Condition (*myPlaybook* = 1, control = 0)	0.06	0.05	1.14	.256	0.03	0.05	0.57	.567
Female	0.14	0.06	2.48	.013	0.02	0.06	0.36	.719
Race/Ethnicity	0.07	0.06	1.21	.226	0.02	0.06	0.35	.727
Change from baseline to 1 month	−0.05	0.07	−0.79	.430	−0.14	0.06	−2.14	.032
Condition (*myPlaybook* = 1, control = 0)	−0.11	0.07	−1.45	.148	0.00	0.08	0.05	.960
Female	−0.00	0.08	−0.05	.962	−0.09	0.07	−1.29	.197
Race/Ethnicity	0.07	0.07	0.94	.347	−0.16	0.10	−1.58	.113
Change from baseline to 4 months	0.03	0.08	0.39	.693	−0.20	0.07	−2.81	.005
Condition (*myPlaybook* = 1, control = 0)	−0.16	0.09	−1.89	.059	−0.10	0.12	−0.89	.375
Female	−0.06	0.08	−0.79	.430	−0.09	0.08	−1.12	.261
Race/Ethnicity	0.13	0.11	1.21	.228	−0.01	0.09	0.08	.933

4.2. Effects of treatment on outcomes

Treatment condition was not associated with change in avoidance of DG between baseline and 1M or between baseline and 4M (Table 2, left columns). In addition, treatment condition was not associated with change in avoidance of pregaming at either time point (Table 2, right columns). Neither gender nor race/ethnicity were associated with change in either DGs or pregaming at

either follow-up. We re-ran our analyses without gender in our models and our findings remained the same; for completeness, we retained the models that include gender as a covariate. Exploratory models also did not reveal an effect of athletic season (in- vs. off-season) or an interaction between athletic season and treatment condition on change in outcomes at either time point.

5. Discussion

In the present study, we evaluated the effects of *myPlaybook* (a student-athlete specific intervention designed to address harmful drinking behaviors) on change in student-athletes' avoidance of DGs and pregaming during the prior 30 days, occurring between baseline and both 1-month and 4-months post-intervention. Controlling for gender and race/ethnicity, results indicated that treatment condition was not associated with change in avoidance of either DGs or pregaming at either of these time points (see Table 2). Furthermore, athletic season (in/off) did not moderate treatment effects on these behaviors. The strengths of the present study include multiple assessment points, the large multi-ethnic sample, and the use of an accessible intervention.

Previous work in this field has shown that college alcohol interventions may result in modest or no change in participation in DGs or pregaming (Borsari et al., 2016; Croom et al., 2009, 2015; Fernandez et al., 2017). Although our findings align on the side of no change (also found in study site 2 in Croom et al., 2015, trial 2 in Fernandez et al., 2017, and Borsari et al., 2016), there are two points worth highlighting regarding the present study. First, we measured DG and pregaming behaviors differently than past studies (i.e., measuring avoidance of, rather than engagement in, these behaviors) and focused specifically on student-athletes, making it difficult to draw direct parallels with these studies. Second, *myPlaybook* is somewhat different than some other online health interventions where young adults might participate in them because they are experiencing some challenges with substance use and might therefore be motivated to get help. In the case of *myPlaybook*, student-athletes were strongly encouraged or required to participate in the intervention, so it is possible that these participants did not see themselves as having any problems and thus felt no urgent need to change their drinking behavior; these factors could have facilitated inconsistent engagement with the intervention. Nevertheless, the present multisite randomized controlled study is the first to report on the efficacy of a web-based, skills-building intervention in influencing student-athletes' avoidance of DGs or pregaming as a protective behavior strategy when drinking.

The reasons for this study's null intervention effects are not entirely clear; yet, it is possible that some student-athletes may not always be able to extrapolate beyond what is directly presented to them in the intervention. As such, *myPlaybook* could be adapted in such a way that it specifically addresses DG and pregaming behaviors by incorporating social norming (Merrill et al., 2016; Pedersen and LaBrie, 2008) and motivation-matched intervention strategies (e.g., Blevins and Stephens, 2016; Canale et al., 2015; cf. Zamboanga et al., 2018) around these specific behaviors. More emphasis could be placed on the use of specific protective behavioral strategies that are particularly relevant in reducing risk for harm in the context of DGs and pregaming (e.g., use of alternate alcoholic and non-alcoholic beverages while playing DGs or pregaming).

Awareness of the health risks associated with heavy alcohol consumption does not appear to influence young adults' decision to play DGs (Polizzotto et al., 2007), which might also be the case for pregaming. This may explain the limited potency that alcohol education (with or without personalized feedback), skills-building interventions such as *myPlaybook,* or BMIs have on college students' DG or pregaming behaviors. Given that young adults' experiences with alcohol-related consequences are highly nuanced, Merrill et al. (2018) have cautioned against assuming that young adults perceive the consequences that occur on all drinking occasions to be negative. Thus it may be helpful to have student-athletes consider what kinds of consequences have occurred as a result of playing DGs or pregaming and then assess the extent to which they perceive these consequences as positive or negative (Merrill et al., 2018). Finally, because the sports team culture tends to promote social cohesion among teammates (Zhou and Heim, 2014), and given the competitive lifestyle of many student-athletes, the presence of team drinking activities like playing competitive DGs could make participation in these games difficult to avoid. *myPlaybook* could be adapted so that student-athletes are provided with alternative activities (e.g., pick-up games or athletic activities) that are also competitive but do not involve alcohol use.

5.1. Limitations and future directions

Study findings should be considered in light of several limitations. First, we used single item measures of our outcomes. Although there is a preponderance of research indicating that these risky drinking practices are associated with more alcohol consumption and increased risk for negative consequences (Foster and Fergusson, 2014; Zamboanga et al., 2014, 2016), simply engaging in these activities may not necessarily result in heavy drinking. As such, we recommend that future work use multi-item measures of DG and pregaming specific and non-specific drinking behaviors, protective strategies, and consequences, in order to tease apart the unique risk conferred by these behaviors. Second, although *myPlaybook* and other interventions targeted at general alcohol use do not seem to have a secondary effect on DG or pregaming behaviors, and despite a recent study indicating that frequency of pregaming participation was not affected even when discussed in the context of BMI (Borsari et al., 2016), the efficacy of existing intervention approaches in reducing students' involvement in pregaming or DG is subject to further inquiry. Third, we acknowledge the low retention rates in the present study and that data were not missing completely at random. Of note, each of the variables associated with missingness (treatment condition, gender, racial/ethnic background, and baseline drinking frequency) was included in our models as a covariate or variable of interest, and results from the models conducted with the original data set did not differ from those using multiple imputation, bolstering confidence in our findings. Despite missing assessment data, adherence to treatment was generally good, with most participants completing all modules. This suggests that the intervention was likely easy to access and engaging to participants.

Finally, although we recognize that the culture of university athletics in the U.S., or at least certain aspects of it (e.g., large athletic scholarship funds, stadiums, and student/alumni fan bases), are quite different compared to other countries, we would expect similar results across different cultures with similar student-athlete university structures. In other words, we have no reason to expect that student-athletes in universities outside the U.S. would somehow show increased avoidance of DG and pregaming from *myPlaybook* when U.S. students do not.

However, we remain open to the idea that there could be cross-cultural factors (e.g., individualism-collectivism; independence-interdependence) that might influence student-athletes' level of engagement in an intervention that is required by the university and/or their coaches. As such, future research could examine this possibility.

6. Conclusions

We found no evidence that *myPlaybook* is efficacious in influencing student-athletes' avoidance of DGs or pregaming as a protective behavioral strategy in the past 30 days. Nonetheless, our findings should be considered in light of other studies that did and did not find reductions in DGs or pregaming participation following other intervention approaches. Furthermore, while the goal of *myPlaybook* is to reduce alcohol use, it does not specifically address DG and pregaming behaviors. In closing, the present study contributes to the alcohol literature as an important first step in helping researchers and practitioners, especially in countries where many young people participate in athletics (Zhou and Heim, 2014), pregame (Labhart et al., 2017), and/or play DGs (e.g., Dumbili and Williams, 2017; George and Zamboanga, 2018; Moss et al., 2015), gain a broad understanding of what may or may not be effective in reducing student-athletes' risk for playing DGs or pregaming.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2019.02.016.

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