Health Or Harm: The Role Of Fitness Technology On Safe Drinking Choices

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Abstract

Alcohol use is a pervasive problem on college campuses with nearly 80% of college students drinking and 40% binge drinking[1, 2]. Such high rates of alcohol consumption are alarming because alcohol use is associated with decreased academic performance and increased risk of sexual assault[3, 4, 5]. Although many college students engage in risky alcohol related behaviors, it appears students have an elevated concern for monitoring their health with fitness technology, such that there are over 10.9 billion Fitbit users and 77.8% of college students perform cardio exercises at least once a week[1, 6]. However, no study has looked at if those who use fitness technology make healthier drinking choices than those who do not use fitness technology. Due to the fact fitness technology encourages health behaviors, the authors predicted that those who wear fitness technology would make healthier decisions when drinking alcohol compared to those who do not wear fitness technology. To test this hypothesis an electronic survey with questions on fitness tracker usage and the Protective Behavioral Strategies scale was sent to undergraduate college students at a Midwest, mid-sized university[7]. Results suggested that students who use fitness technology are more likely to limit/stop their drinking and take action to avoid serious harm from drinking compared to those who do not use fitness technology. These results are important to universities who may want to leverage technology to promote healthy and safe drinking decisions. However, more research is needed to know if the fitness technology itself encourages safer drinking decisions or if those students who use fitness technology are already more aware of the impact their decisions have on their health, and thus they make both smarter drinking and fitness decisions.

Keywords: Alcohol, Fitness Technology, Protective Behavioral Strategies

1. Introduction

Alcohol use continues to be a pervasive problem on college campuses with nearly 80% of college students drinking and 40% of students binge drinking[1, 2]. The college population is particularly vulnerable to excessive alcohol consumption due to now living away from home, participating in Greek life, and wanting to fit in with classmates and the campus culture[8, 9]. Unfortunately, those students who drink more often and in higher quantities perform worse at school and miss more class than those who do not binge drink[5, 10]. Furthermore, college students' risk for binge drinking not only is a concern to their academic success, but their health. For instance, studies show that alcohol use on college campuses is involved in at least 50% of student sexual assaults and may contribute to over 500,000 student injuries each year[3,4]. Clearly, when students drink alcohol excessively, both their school success and health are at risk.

1.1. Health and Fitness Technology

Although many college students disregard their health when drinking, it does not appear that they disregard their health altogether, especially in terms of eating healthy and exercising. The American College Health Association reports that over 90% of college students eat one or more servings of fruits and vegetables a day[1]. Additionally, 58%

of students report doing some form of moderate cardio exercise for at least 30 minutes, 1-4 times a week[1]. Thus, over half of all college students meet the American College of Sport's Medicine's recommendation of 150 minutes of weekly exercise[11]. These elevated levels of exercise and healthy eating among college students demonstrate that they are concerned about some aspects of their health, although alcohol may not be one of them.

College students' concern about their fitness and diet is evident in the rising popularity of health and fitness technology. This sort of technology includes digital applications and wearable technology that is used to monitor physical activity and/or food consumption[12]. These technological devices are especially popular among young adults, such that one study of over 150 young adults reported that 50% of its participants, ages 18-34 used a fitness app to monitor their health[13]. Additionally, the popular fitness tracker, Fitbit, has over 10.9 billion users alone[6]. Fitness technology's large reach is notable because fitness technology is not just a product people purchase, but a tool used to assist people in setting and achieving their health goals. There is evidence supporting the idea that when people use fitness technology to monitor their physical activity they often increase the amount of time spent exercising and number of steps taken each week[14]. The combination of the rise in fitness technology and the fact that over half of all college students meet the recommended weekly exercise levels suggests students do care about some aspects of their health.

1.2. Alcohol Protective Behavioral Strategies

Just as fitness trackers decrease health risks associated with inactivity and improper nutrition, studies have found certain variables, behaviors, and skills decrease the risk of alcohol related consequences[7, 15, 16]. One specific type of strategy that has gained recent interest due to its ability to prevent dangerous consequences associated with excessive alcohol consumption is the Protective Behavioral Strategies (PBS) approach[7, 10, 15]. PBS are defined as a set of decision making skills people can implement throughout a drinking episode[7]. Such strategies include planning to stop drinking at a certain number of drinks, alternating alcoholic and non-alcoholic drinks, pacing the number of drinks consumed, and avoiding drinking games[7]. Unlike many alcohol interventions or factors that impact alcohol use, PBS are an active way to decrease both alcohol consumption and alcohol related consequences[15]. For instance, one study showed that students who drank at least six drinks and utilized PBS while drinking were less likely to be hospitalized for alcohol related injuries/illness and pass out compared to students who drank the same amount, but did not use PBS[7, 10]. Furthermore, PBS may interest health care professionals and college administrators because not only do PBS protect against alcohol overdoses, but also decrease one's chance of getting in trouble with authority figures and decrease the likelihood students will perform poorly on a test due to alcohol consumption[7, 10, 17].

1.3. Protective Behavioral Strategies and Fitness Technology

Although, studies on PBS often recommend administrators and counselors to teach college students PBS to decrease alcohol related consequences, the studies do not address specific ways to encourage students to use PBS[7]. Additionally, no study has explored if fitness technology, a tool that already successfully encourages smart exercise and nutrition decisions, may also encourage safer drinking decisions through the use of PBS. Thus, the purpose of this study was to examine if fitness technology relates to safer and healthier drinking decisions similar to its relationship with smart nutrition and physical fitness habits. More specifically, the study considered if those who use fitness technology make healthier drinking choices through employing more PBS than those who do not use fitness technology.

Due to the fact fitness technology encourages health behaviors, the authors hypothesized that those who use fitness technology would make healthier decisions when drinking alcohol compared to those who do not use fitness technology; therefore, showing that fitness technology may encourage safer alcohol consumption. Such a study on the role of fitness technology on college students' drinking is important because it may help universities develop ways to reach students through technology to promote healthy and safe drinking.

2. Methodology

2.1. Participants

A total of 534 college students from a mid-sized midwestern university ages 17-30 ($M = 20.2$, $SD = 1.36$) participated in the study. A majority of students were Caucasian ($n = 481$, 90.1%), female ($n = 398$, 74.5%) and/or college seniors ($n = 206$, 38.6%). Other participants self-identified as Asian/Asian American ($n = 26$, 4.9%), Hispanic ($n = 15$, 2.8%), African American ($n = 10$, 1.9%), Pacific Islander ($n = 3$, 0.6%), and other ($n = 3$, 0.6%). Additionally, the academic standing of the participants included freshman ($n = 63$, 11.8%), sophomores ($n = 146$, 27.3%), juniors ($n = 109$, 20.4%), seniors, 5th year seniors ($n = 3$, 0.6%), and graduate students ($n = 4$, 0.7%).

2.2. Procedure

After receiving approval from the Institutional Review Board, an online survey was distributed through snowball sampling technique to the participants. Research assistants and academic personnel distributed the survey on social media, extra-curricular listservs, and class announcements. Some participants received extra credit for completing the survey. All participants who completed the survey were entered into a drawing to win one of four $50 gift cards.

2.3. Measures

2.3.1. alcohol consumption

The online survey asked 30 questions about the participants' alcohol consumption habits. The survey included questions on the number of times participants had gotten intoxicated and/or binge drank in the past 30 days, the number of times participants had gotten intoxicated and/or binge drank in the past week, and the greatest number of drinks they had had in the past 30 days and in the past week. Other questions asked about what days of the week participants drank, if they participated in drinking games, and if their families indicated a history of drinking problems. To standardize responses a drink was defined as 12 oz. of beer, 5 oz. of wine, or 1.5 oz. of liquor[18].

2.3.2. protective behavioral strategies

Participants answered the 15 question Protective Behavioral Strategies (PBS) questionnaire[7]. These items were used to measure to what degree participants make drinking decisions that lower their risk of experiencing alcohol-related consequences and lower the amount of alcohol they consume[7]. For each of the 5-point Likert-scale items participants indicated how often they engaged in a certain behavior by selecting a choice from 1-5, where 1 represented never and 5 represented always. The scale was broken down into three subscales: Limiting/Stopping Drinking, Manner of Drinking, and Serious Harm Reduction[7]. The Limiting/Stopping Drinking subscale asks seven questions on decisions made to stop drinking or slow down drinking. Manner of Drinking ($n = 5$) asks about the context of a drinking episode and how a person consumes the alcohol (e.g. "avoid drinking games"). Finally, the three Serious Harm Reduction items ask about steps participants take to prevent severe injury and death (e.g. "use a designated driver"). A full list of the questions can be seen in Table 1.

Table 1. A list of the Protective Behavioral Strategy items by each subscale.

Subscale	Item
Limiting/Stopping Drinking	Determine not to exceed a set no. of drinks
	Alternate alcoholic and nonalcoholic drinks
	Have a friend let you know when you've had enough
	Leave the bar/party at a predetermined time
	Stop drinking at a predetermined time
	Drink water while drinking alcohol
	Put extra ice in your drink
Manner of Drinking	Avoid drinking games
	Drink shots of liquor (reverse scored)
	Avoid mixing different types of alcohol
	Drink slowly, rather than gulp or chug
	Avoid trying to "keep up" or out-drink others
Serious Harm Reduction	Use a designated driver
	Make sure that you go home with a friend
	Know where your drink has been at all times

2.3.3. fitness technology

The survey also included questions on participants' use of fitness technology. The first question asked participants to select either "yes" or "no" indicating if they used some sort of fitness technology. Other questions asked the participants for what portion of the day they wear fitness technology ("all day/when awake", "only when I exercise", "other"). Lastly, participants were asked for what purposes they use fitness technology. They were asked to select all features that they use including to track food intake, heart rate, exercise, and calories burned.

3. Results

3.1. Alcohol Consumption

A total of 493 (92.1%) out of 534 students reported ever having had an alcoholic drink. Additionally, 428 (80.1%) students stated that they had had four or more drinks in one drinking occasion during the past month, meeting or almost meeting the criteria for binge drinking (four or more drinks in one drinking occasion is the binge drinking criteria for women whereas five or more drinks is the criteria for men)[19]. Students who stated they drank four or more drinks on occasion indicated doing so on average 3.09 times ($SD = 1.46$) a week. Additionally, of those participants who reported drinking any amount of alcohol, it was found that they drank on average 2.0 days a week ($SD = 1.49$), with an average consumption of 3.60 ($SD = 2.38$) standard drinks each time. The average for the highest number of drinks consumed during one drinking occasion in the past month was 6.72 ($SD = 5.00$).

3.2. Fitness Trackers

3.2.1. fitness tracker usage

A total of 132 (24.7%) participants reported using some form of a health app. Of those 132 participants, 67 people (50.8%) indicated that they wear some form of a fitness tracker. One hundred percent of those who reported using some form of health or fitness technology reported doing so to track their exercise, whereas only 66 (48.5%), 64 (48.5%), and 20 (15.2%) of health and fitness technology users reported using such items for keeping record of calories burned, recording of food intake, and monitoring heart rate, respectively.

3.2.2. fitness trackers and alcohol

An independent t-test revealed no statistically significant difference in the number of times participants drank four or more drinks on one occasion or in the typical number of drinks consumed on drinking days between those who wear fitness trackers and those who do not wear fitness trackers.

3.3. Protective Behavioral Strategies

3.3.1. protective behavioral strategy usage

On the PBS Manner of Drinking subscale 353 participants answered yes to at least one of the subscales questions, with an average score of 14.7 ($SD = 4.36$, Cronbach's Alpha = 0.69). On the Limiting/Stopping drinking subscale 350 participants indicated using this strategy with an average score of 19.0 ($SD = 6.67$, Cronbach's Alpha = 0.83). Lastly, 353 participants indicated utilizing Serious Harm Reduction PBS with an average score of 12.7 ($SD = 2.70$, Cronbach's Alpha = 0.71). Thus, students tended to use more Limiting/Stopping drinking PBS than the Manner of Drinking and Serious Harm reduction PBS.

3.3.2. fitness trackers and protective behavioral strategies

A series of independent t-tests revealed that students who use fitness technology ($M = 20.22$, $SD = 6.27$) limit/stop their drinking sooner than students who do not use fitness technology ($M = 18.49$, $SD = 6.71$), $t(278) = 2.20$, p < 0.05. Additionally, students who use fitness technology ($M = 13.21$, $SD = 2.16$) take more steps to prevent serious harm to themselves when drinking than those who do not use fitness technology ($M = 12.35$, $SD = 2.89$), $t(281) = 2.72$, p < 0.05. However, there was no difference between students who use fitness technology ($M = 15.10$, $SD = 4.43$) and those who do not ($M = 14.55$, $SD = 4.21$) in the manner in which they drink, $t(281) = 1.056$, p = .292.

4. Discussion

4.1. Discussion

In general, those students who use health apps and fitness technology tend to implement more protective behavioral strategies than those who do not; however, this conclusion only holds true for Limiting/Stopping Drinking and Serious Harm Reduction PBS. Thus, the results of the survey partially support the hypothesis that people who use fitness technology make safer and healthier decisions when drinking compared to those who do not use fitness technology. Fitness technology encourages people to use protective behavioral strategies to prevent serious harm or death from intoxication and to limit or stop their drinking (See Table 1 for list of items); however, it does not encourage people to engage in more PBS in terms of the manner in which they drink.

The fact that fitness technology did not change the manner in which people drink expands upon the current understanding of the effectiveness of PBS in that it indicates PBS may only work in certain contexts; there are other factors influencing students' decisions to drink that may over rule their concern for their health and safety, the two factors the PBS promotes[7]. For instance, one of the questions on the PBS Manner of Drinking scale is rate the degree to which you "avoid drinking games", a highly social activity[7]. Thus, because people who use fitness technology and people who do not were equally likely to engage in drinking games, the social context and norms surrounding the drinking activity may play a greater role in the likelihood one will use PBS than health concerns. This conclusion aligns with other studies that have shown students are motivated to drink in order to enhance their social experience by playing a drinking game or attending a Greek life party, which ultimately leads to more binge drinking[20, 21]. In other words, people many times are not drinking to improve their health, but to socialize. Therefore, the social drinking norms on college campuses may make it more likely that students engage in poor decisions in terms of alcohol consumption. Additionally, it makes sense that no difference was found between participants on the Manner of Drinking PBS scale because it has been found that this subscale is the subscale most correlated to the amount of alcohol students consume and the number of alcohol related consequences experienced[7]. In other words, a person who does not use the strategies on the Manner of Drinking Scale (avoid drinking games, etc.) is more likely to drink

excessively and experience harm than those who do not use the strategies from the other two scales. Thus, the strong association between Manner of Drinking and alcohol related consequences may make it more difficult for a fitness tracker or app, a passive environmental cue, to vicariously influence drinking decisions. Taken together, the results of the study suggest more research needs to be done on PBS, social norms, and other factors that influence decision making social contexts.

One other possible explanation for why there was no difference on the number of PBS participants used from the Manner of Drinking subscale is the time of reference to the drinking occasion each subscale asks about. Although it is true, as Martens and colleagues put it, PBS are used to help make smart drinking decisions when out drinking, each subscale varies slightly in terms of if it asks questions about the person's pre-drinking planning, actual alcohol consumption, or post-drinking activities[7]. For instance, the items on the Manner of Drinking subscale, unlike the other two scales, asks questions about a person's drinking decisions while they drink (e.g. "drink shots of liquor", "avoid trying to outdrink other drinkers"). Thus, these scale items reveal information about how quickly people drink and how strong of a drink they consume, two in the moment decisions[7]. When someone is in the moment of drinking, as mentioned previously, social norms are highly salient[21], more so than a fitness tracker or app, which may in turn influence one's decision to drink more.

On the other hand, many of the items on the Limiting/Stopping Drinking and Serious Harm Reduction subscales ask questions about decisions made either directly before or directly after the person consumes the drink, allowing more time for planning. The distinction on the timing of the PBS on the scale is important because it adds to the literature on the effectiveness of certain alcohol planning intervention methods. One such study looked at the importance of planning verses not planning out how and when to implement a safe alcohol consumption strategy on the levels of binge drinking[22]. The authors found that participants who chose a strategy on how to refuse a drink and when they would use that strategy before going out for the night, binge drank less than those who did not plan how to refuse a drink[22]. Perhaps, PBS work in a similar manner; PBS are more effective when they require people to plan out safe drinking verses relying on in the moment decision making when other environmental cues, besides fitness trackers, are highly salient. The result that participants used the Limiting/Stopping Drinking PBS more than any other type of strategy further supports this conclusion. Given fitness trackers are known to increase health awareness and help people track calories and plan out fitness goals, it makes sense that those who use fitness trackers use more of the pre-drinking Limiting/Stopping Drinking PBS[14, 23]. In other words, because many alcoholic beverages contain some calories and those who use fitness trackers monitor their caloric intake, people who use fitness trackers may also plan out the calories in their alcoholic drinks before a drinking occasion, thus limiting their alcohol consumption more than those who do not use fitness technology to track their health.

Similarly, many of the Serious Harm Reduction questions do not ask about PBS used during the actual consumption of the alcohol, but about drinking decisions made immediately after drinking. In the moments after the drinking episode, students may have more time to reflect on the consequences of their night's drinking. For instance, when a person who has been drinking is ready to go home they must decide to either go home with a person who has not been drinking (the designated driver) or drive home themselves, risking a car crash. When the attention is shifted from drinking with friends to getting home safely, students may reflect more on their health versus being distracted by the social context of their drinking. However, this does not explain why people using fitness technology utilize more of these serious harm reduction protective behavioral strategies. One possible explanation is that fitness technology encourages more long term health goal achievement and increases a person's awareness about their health[14]. Thus, those who use fitness technology may be more aware of how small decisions, such as deciding not to drink and drive, impacts their overall health and therefore, use more PBS strategies to prevent serious harm.

4.2. Implications

The fact that fitness technology was correlated to the use of more PBS in terms of serious harm reduction and limiting/stopping drinking indicates fitness technology may be a good way to teach students protective behavioral strategies that can be used throughout a drinking episode. Integrating health and fitness technology with protective behavioral strategies makes sense because both tools have been effective in improving health behaviors[10, 14]. Fitness technology has been found to encourage weight loss and help students in setting their fitness goals[14]. Similarly, protective behavioral strategies have been shown to encourage healthy decision making, which prevents many alcohol related consequences[7, 15]. For instance, one study found those college students who use more PBS when drinking have higher GPAs and academic performance than those who do not use PBS[17]. Given both fitness technology and PBS improve health related outcomes and this study found that those who use fitness technology engage in more PBS in terms of the Serious Harm Reduction and Limiting/Stopping drinking subscales suggests that fitness technology may

be a new, effective tool that can be used to increase the use of PBS. Additionally, the rise in the popularity of fitness technology makes it a more compelling intervention tool.

Although it appears those who use health and fitness technology use more PBS than those who do not use fitness technology, this finding must be interpreted in the context of the participants' overall alcohol consumption patterns. Surprisingly, it was found that those who use fitness technology drink large quantities of alcohol (four or more drinks at a time) about as frequently as those who do not use fitness technology. Thus, it appears that fitness technology's ability to influence drinking decisions and encourage PBS when PBS are not taught is small. However, these results do not mean that fitness technology is not an effective tool that can be modified to teach PBS. As Martens and colleagues and others have found, the use of PBS significantly decrease the amount of alcohol consumed and the number of alcohol related consequences experienced[7, 15]. Additionally, there is not yet one standard way to teach PBS to students. Some of the most effective alcohol intervention methods, including the online education class AlcoholEdu, feature many of the components fitness trackers have[16]. Two of those components are skills training through self-monitoring and personalized feedback[16]. Perhaps if health and fitness technology users were taught how to use their devices in a way that not only tracked their diet/fitness goals, but their alcohol safety goals, fitness trackers would be more effective at lowering dangerous alcohol consumption levels. More research is needed to test the effectiveness of fitness trackers as an alcohol intervention method before dismissing its potential.

4.3. Limitations And Future Research

While the results are encouraging, caution should be used when interpreting the findings. First, as mentioned the population of this study was only college students. Given that college is a unique atmosphere where students live near each other and are influenced by many social pressures, such as fitting in with Greek life[21], these results cannot be extended to all populations. Additionally, because the study used participants who were not randomly assigned and used self-report data, the results are only as valid as the honesty of the participants. Furthermore, this study is limited in that the sample was relatively homogenous, with a majority of participants being white females from the Midwest between the ages of $17 - 30$ ($M = 20.2$, $SD = 1.36$). Lastly, this study does not address if it is the fitness technology itself that encourages the use of PBS or if those who use fitness technology are already more aware of their health decisions and thus use both more PBS and fitness technology.

Given these limitations, future research should focus on recruiting a more diverse sample. A future study may want to randomly assign participants who currently do not use fitness technology to either begin using fitness technology or to continue not using fitness technology, decreasing biases associated with non-random samples. Lastly, future research may want to consider using a personality measure to see if those who use fitness technology are more health aware so they already make healthier decisions or if the fitness technology encourages its users to implement more PBS.

Despite the limitations, the results are important because they extend the current alcohol literature in that they provide additional insight into a possible tool for decreasing alcohol related consequences and encouraging safer drinking decisions. The study's large sample size increases the validity of the results for the given population. Furthermore, the fact this study focused on college students alone may not be a disadvantage given that college students binge drink more than other populations[24]. Thus, the study's results can be tailored for interventions among college students. These results are of particular interest to school administrators because it has been found that students who use PBS perform better in the classroom, get along better with authority, and do not fail class as often compared to students who do not use PBS[10, 17].

5. Conclusion

In conclusion, this study partially supported the hypothesis that those who use fitness technology make safer and healthier drinking decisions than those who do not use fitness technology. The hypothesis held true in that those who reported using fitness technology also used more PBS in terms of limiting/stopping their drinking and preventing serious harm to themselves than those who do not use fitness technology. However, the hypothesis that those who use fitness technology make safer drinking decisions than those who do not was challenged by the fact participants did not differ on the number of PBS from the Manner of Drinking. Thus, it appears that fitness technology is a potential tool to teach PBS; however, more research is needed on when and how fitness technology can be used to teach PBS in order to decrease the amount of binge drinking and alcohol related consequences for college students.

6. Acknowledgements

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