Exploring New Design Factors for Electronic Interventions to Prevent College Students from Excessive Drinking by Using Personal Breathalyzers

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Abstract

Excessive drinking among college students is a significant public health issue. Electronic Screening Brief Intervention (e-SBI) has been shown to be an effective prevention device, and it has been instrumented on personal computer, web, mobile phones or social networking platforms. In this research, we asked college students to discuss about their perception of BACtrack Mobile Pro, the first FDA-approved personal smart breathalyzer. We recruited 15 college students who have consumed alcohol regularly and asked them to use the smart breathalyzer for two weeks. We conducted online surveys and in-person interviews. We identified five main issues of the smart breathalyzer from the participants: (1) Support from immediate family members or close friends, (2) Personalization, (3) Intuitive display of results, (4) Attachment to users, and (5) Quicker access. Future mobile and smart wearable e-SBI interventions targeted at college students should take these design considerations into account in order.

Introduction

Excessive drinking among college students is a serious public health issue. According to Centers for Disease Control and Prevention, excessive drinking includes heavy drinking, which is defined as drinking 15 drinks or more per week for men and 8 for women, and binge drinking, which is defined as a pattern of drinking that causes the blood alcohol concentration (BAC) level to over 0.08%¹. A national survey shows that, about 60 percent of college students whose ages are between 18 to 22 have consumed alcohol excessively in the previous month¹. Excessive drinking could bring serious risks to students’ health and safety that could result in car accidents, sexual-assaults, bodily injuries, and long-term liver and kidney damage. About 1,800 students between 18 years old and 24 years old die annually from alcohol-related accidents¹. While problems related to excessive drinking is well publicized, many college students perceive drinking as a part of their college life and subsequently establish drinking habits when they leave home to attend college after graduating from high school¹.

With recent advances in information and communication technologies (ICTs), electronic Screening Brief Intervention (e-SBI) has been found to have the potential of reducing the amount and frequency of drinking and is considered to be an effective prevention mechanism for young adults⁶. In this paper, we first introduce existing literature on traditional and e-SBI studies. We then describe the results of our user inquiry involving BACtrack Mobile Pro, the first FDA-approved personal smart breathalyzer, as an intervention in a series of surveys and interviews with college students who consume alcohol regularly. We report five issues related to current smart breathalyzer design and propose future work in this space.

Related Work

The screening and brief intervention (SBI) is designed with the intent to assess a person’s alcohol consumption behavior with a series of questions about a person drinking patterns. Traditional SBI is typically provided by healthcare professionals in face-to-face setting with in-person feedback, which includes information about one’s alcohol consumption, its risks, benefits of lowering alcohol consumption, and suggestions for adjusting drinking patterns. If appropriate, the healthcare professional may provide referral to treatment⁷,⁸,⁹. Although SBI has been found to be effective in reducing alcohol consumption and related problems based on the 34 randomized controlled trials studies¹⁰, there are several limitations that prevent the healthcare professionals from deploying the intervention effectively. According to healthcare staff report, they suffered from the lack of skills, knowledge, time, and resources for conducting SBI¹¹,¹². When it comes to adoption of SBI among college students, research has shown that they are sensitive to get assessment by a healthcare practitioner about drinking, and they tend to be more interested in receiving personalized feedback⁶.

Unlike traditional SBI that includes face-to-face feedback, e-SBI could provide a personalized feedback about excessive drinking via electronic medium such as web, text messages, mobile phone apps, and social network platforms. For e-SBI, it is possible to offer more anonymity and flexibility to the subjects, and dissemination through digital medium has the potential of reaching more people who may benefit from SBI. For young adults, anonymity
that is afforded by e-SBI with electronic alcohol risk assessment and personalized feedback is more preferred than direct intervention with face-to-face assessment and in-person feedback by healthcare professionals. Recent systematic reviews for e-SBI show that e-SBI is effective for reducing alcohol consumption. In the case of Internet-based SBIs, they are cheap to implement and deploy, are possible to access widely at any time, and could mitigate concerns relating to stigma among one’s social circle. More recently, the wide adoption of smartphones provides an additional platform for e-SBI, and research has pointed to its potential to impact drinking disorders. While research shows there are many positive effects of e-SBI, some studies find that the intervention does not result in any significant effect on one’s behavior, and may not be effective after a period of 12 months or longer.

Other interventions involve peer support such as receiving notification messages from family and friends. Research has shown that this type of interviews more effective when it is delivered over the web or through individual face-to-face sessions in periods shorter than 3 months. However, peer support intervention does not yield significant long-term effect for via e-mail and medium in a long-term follow-up study. For smartphone applications that calculates blood alcohol concentration (BAC), research shows that there is in fact a significant increase in drinking frequency and BAC level among participants. Researchers of the study attributed the findings to the fact that more male participants were represented in the study, and that they were more likely to treat the BAC level as a competitive social game. Furthermore, interactive interventions have been found to be effective at behavior change, it is suggested that the appealing features of design and contents with low user burden and more interactive elements should be considered for alcohol-related devices and services.

In general, while there has been several studies that point to the potentials of e-SBI for reducing alcohol consumption among young adults due to its ease of access and anonymity, there is very little research that involved the use of smartphone and wearable devices. To our knowledge, there has been no prior reporting of a consumer-oriented breathalyzer device. In this paper, we describe an exploratory study that involves the use of a personal breathalyzer device that can be paired to one’s smartphone.

**BACtrack Mobile Pro**

BACtrack Mobile Pro is an only consumer breathalyzer that has been developed and released by the FDA-approved company BACtrack. It is developed to monitor and manage one’s BAC and drinking habits by linking to a smartphone or a smart watch. It has an additional function such as calling Uber. The Figure 1 shows BACtrack Mobile Pro that was given to the participant for the research.

![BACtrack Mobile Pro](image)

**Figure 1. BACtrack Mobile Pro**

**Methods**

The goal of this research is to understand college students’ culture of alcohol consumption and how the smart breathalyzer could influence on them, and how the design of the device and application could be potentially improved to prevent college students from excessive drinking. We selected BACtrack Mobile Pro as the device to use for our research since BACtrack is the first, and currently the only, company to obtain FDA approval to manufacture and market breathalyzers for consumer use. Consumer reviews on Amazon.com also shows higher user satisfaction than other competing products. BACtrack Mobile Pro can connect to BACtrack app for a smartphone via Bluetooth. Through an attached mouthpiece of the device, a user could blow and check her/his BAC on the app. The app can
store BAC levels and users can retrieve and compare them over time. Moreover, depending on the BAC level, the app also display user’s status and suggestions when the results of BAC appear. Figure 2 shows screenshots of the app.

![Figure 2. Screenshots of BACtrack application](image)

We recruited undergraduate students by advertising the research through social media and snowball sampling. Our target population was college students who are over the age of 18 and consume alcohol at least once per week.

We conducted in-person interviews to learn more about the drinking culture of college students. Participants were informed about the research process and signed an informed consent form approved by Indiana University’s Institutional Review Board (IRB). They were given a short tutorial on how use the device and the smart phone application, and they were given the breathalyzer to use for 2 weeks. After the end of each week, we sent short surveys to query their usage experience in the previous week. Finally, we collected a post-study questionnaire and conducted follow-up interviews to explore how the device have influenced their alcohol consumption perception and behaviors, and to uncover issues with device usage. The interviews were audio-recorded and transcribed for analysis. We then conducted open coding and iteratively refined the emerged themes.

**Results**

We recruited 9 female and 6 male college students with age ranging from 19 to 27 years old. They used the device between 2 to 7 times during the two-week period. We identified five main issues relating to breathalyzer usage as a form of electronic intervention on drinking: (1) **Support from immediate family members or close friends**, (2) **Personalized results**, (3) **Intuitive status display**, (4) **Accessorizing the form factor**, and (5) **Quicker access**.

**Support from immediate family members or close friends**

BACtrack Mobile Pro provides functions such as BAC level calculation, call Uber, and share the data anonymously. At the beginning of the study, we expected that they might not want to share any alcohol-related information (e.g. BAC, status, or location) with others. However, the college students said they were fine with sharing it with their immediate family members and close friends. According to participants, they used the sharing functions both to get help and provide support to their family and friends through the app. For instance, if a user registers their family members or friends on the app, they will receive notifications if the app detects an abnormally high BAC level.

"If I see one of my friends has a high BAC level, I will call and check on them to make sure they are ok." 

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“If I show my BAC level and status when I feel drunk, I can show it to my friends and let them know I should stop drinking. Then, they might not give me more shots.”

“I can share my BAC level with my friends when we drink together. Sometimes I may look fine to my friends, but I was actually drunk. So this BAC level would help me prove that I am drunk and that I won’t be pressured into drinking more.”

Participants also mentioned that they needed more meaningful representation of their BAC level; some of them have trouble understanding the meaning and difference between readings such as 0.08 and 0.12. A more meaningful visual representation is needed to help those participants understand their alcohol consumption habits.

**Personalized results**

Since each person is different and could react to alcohol differently, the BAC level which is shown on the app might not exactly indicate the precise risk level for each person. Although the color and value of BAC level could indicate the risk level to a certain degree, many of our participants reported that they did not feel drunk when their BAC level exceeded the legal threshold of 0.08. On the other hand, some participants reported feeling drunk despite the BAC level being far below the 0.08 threshold while the app shows a green color.

“I am a light weight compared to other people. When I began to feel a headache from drinking too much and blew the breathalyzer, the color of BAC level was green. The device stated that my status is OK, but I wasn’t. So I feel this is not helpful for me.”

“It would be good if the device knows my condition and gives some alerts to prevent me from having bad symptoms.”

“It should provide personalized information about my drinking in detail. You know, degree of excessive drinking might be different, so if I just get BAC level without any detailed information, it does not have enough value.”

Future design could allow participants to annotate their BAC levels to indicate their personal comfort level, and that could be used to personalize the individual’s status display. For example, the app could display a red color if a user sets the threshold to 0.05 as opposed to the normative 0.08.

**Intuitive status display**

The device shows BAC level, texts and graph on the app. However, many participants stated that they were confused when they saw the results. They did not know how much BAC level is dangerous for operative a motor vehicle. Also, although the app shows what this BAC level means such as user’s possible status and suggestions with texts, they said the messages were too small and lengthy to read and understand, especially when they were drinking or were already drunk. Thus, they suggested that if the results show visual images that correspond to someone’s physical conditions such as passing out or in a form of emoticon, it would help them process the status much more intuitively.

“If the device shows pictures of someone who is passed out or police officer who hands out ticket, it would encourage me to stop drinking. If you are drunk, you might not be able to read the words, but you can see the pictures.”

“I wanna see what each BAC status means. When I used the device and saw the value, I thought ‘Is this BAC level enough for my body? Is this dangerous to drive?’ I don’t understand intuitively.”

**Accessorizing the form factor**

The size of BACtrack Mobile Pro is small enough to be held in one hand. It is convenient to carry in one’s purse or bag, but almost every participant mentioned that they were worried about losing the device because of its size, especially when they were less cognizant of their surroundings when drinking. Also, some participants suggested different shapes of devices such as a watch, a necklace, or a bracelet that could better fit their lifestyle and aesthetic preferences.

“I had it in my purse, but I don’t think it would be easy to carry for male students. It would be better if it could be attached to my cellphone.”

“I don’t wanna lose it.. so I didn’t bring it sometimes”
At first time, I brought and used it. But the next day I was drunk, I almost could not find the device. Then I became really worried if I really lost it... so I always leave the device at home.”

Therefore, future design that investigate different ways of accessorizing the appearance of the breathalyzer and how it can be worn or carried could significantly affect the wider adoption of the device.

Quicker access

To retrieve the BAC level, the user must turn on Bluetooth, open the app, and click on the device to pair the app. When a connection is established, the user needs to wait for the device to ‘warm up’ before s/he can blow into it to get the BAC reading. The device needs to capture enough amount of air that contains alcohol before a reading can be registered. This process could take up to 1 minute. Some participants expressed that the process took too long and it was inconvenient and burdensome to use.

“It was not easy to check my BAC because I was drunk. Why can’t they monitor automatically?”

“I usually forget to use it while I was drinking. It took quite a long time for me to set it up and check my BAC.”

“You know, my device was really slow to turn on the app and Bluetooth. I was trying to check my level in the middle of drinking with my friends, but it took a long time. It was obvious that it disrupted our conversation.”

Today’s smartphone is capable of location detection. It may be possible to program the breathalyzer and the app to enter into a ‘hibernation’ mode so that it could be accessed quicker if the app detects that a user is located in the vicinity of a bar. If automatic detection is not possible, it may be possible to create a manual mode that allows the user to set the connection state manually if they know that they plan to drink that evening.

Conclusion

This ongoing research has explored the issues of using a smart breathalyzer as a potential e-SBI prevention intervention device to prevent excessive drinking among college students. Some limitations of the study include the short usage time (2 weeks) and a relatively small number of users (15 college students). However, the interviews identified many promising design opportunities to improve the app interface and device form factor to allow for better user experience. We plan to design and implement a different smartphone app that integrates with the breathalyzer, and to conduct a longer-term deployment study to understand the potential impact on college students’ perception and behavior of alcohol consumption.

References


