

Attitudes of College Aged Students to Technology Based Alcohol Intervention

An Interactive Qualifying Project

Submitted to the Faculty

of the

WORCESTER POLYTECHNIC INSTITUTE

In partial fulfillment of the requirements for the

Degree of Bachelor of Science

By

Dean Kiourtsis

James Nolan

Katelyne Sibley

Kevin Truc

Date: April, 28th 2016

Approved :

Professor Emmanuel Agu, Advisor

Abstract

Almost half of U.S. college students binge drink. Compared to traditional mediums, technology presents an opportunity to investigate automatic monitoring and passive analysis to provide in-the-moment intervention. This project's objective was learning about the opinions of college aged students to specific technologies that can be used to monitor and control binge drinking. Focus groups and a survey highlighted the concerns of accuracy, ease of use, and relevance to the target audience as key features in a device for this purpose.

Acknowledgements

The project team would like to thank Professor Emmanuel Agu for his support. His continual guidance and encouragement allowed this project to succeed. In addition, we would like to thank all the participants of the focus groups and subjects who responded to our survey.

Contents

1-Introduction	10
1-1-Alcohol and Binge Drinking Statistics	10
1-2-Alcohol Interventions.....	11
1-3-Understanding Binge Drinking and its Effects	12
1-4-Types of Technology	12
1-5-The Goal of this IQP	13
2-Background and Related Work.....	14
2-1-Types of Interventions	14
2-2-Non-Technology Based Interventions	14
2-3-Technology Based Interventions	16
2-4-Related Works.....	17
2-5- Existing Technologies.....	19
3-Methodology.....	25
3-1-Research of new and existing technologies	25
3-2-Conducting the focus group	26
3-3-Conducting the survey	27
4-Results and Analysis.....	29
4-1-Focus Group Results and Analysis	29
4-1-1-Device accuracy	34
4-1-2-Ease of use	34
4-1-3-Privacy Concerns.....	35
4-1-4-Ability to Intervene	36
4-1-5-Multi-functionality	36
4-1-6-Relevance to Casual Drinkers	37
4-2-Survey Results and Analysis	37
4-2-1-Smartphone Gait Inference	39
4-2-2-LBMI-A.....	40
4-2-3-Breathalyzers	40
5-Conclusions	42
References.....	43

Appendix 1: Focus Group Data	47
Appendix 2: Survey Data.....	54
Table 1: List of Researched Technologies.....	20
Table 2: Categorized Technologies	21
Figure 1: Diagram of the fingerprint interlock	22
Figure 2: Soberlink Breathalyzer	23
Formula 1: Sample Size Calculation.....	28
Table 3: Focus Group Subject Demographic Data	30
Figure 3: Frequency of Alcohol Consumptions for Focus Group Subjects.....	31
Figure 4: Frequency of Binge Drinking for Focus Group Subjects.....	31

Executive Summary

Introduction

Excessive consumption of alcohol, such as binge-drinking, is a major, growing concern in the population overall, as well as a particular concern in the youth of college campuses in the United States. Binge drinking is defined by the CDC as 4 drinks for women or 5 drinks for men within a 2-hour timeframe. Furthermore, an alcoholic drink is defined as 12 ounces of beer, 4 ounces of wine, or 1.5 ounces of 80 proof alcohol. There is a long history in the management of alcoholism and rehabilitation due to alcohol abuse. Literature of various programs dating as far back as 1969, illustrates the effectiveness of counseling, therapy, and drugs in curbing alcohol abuse. A study showed that 40% of college students participate in binge drinking. Consequences of binge drinking include increased risk for mental illness, organ failure, injury, and death. Despite its successes, this tradition of rehabilitation has not readily taken advantage of development of recent technological developments. Technology interventions for alcohol abuse can provide unique abilities such as automatic tracking, personalized analyses, and in-the-moment interventions to potential episodes of binge drinking. The goal of this project was to inquire about the positive and negative thoughts, as well as the general feelings that drinking-age college students have towards various alcohol abuse intervention technologies.

Background

In order to better understand how effective a specific technology intervention may be, it is important to identify which category of intervention it fits into, and understand the strengths and weaknesses of said category. The most common methods of intervening in problem drinking are non-technology methods. Among problem drinkers, those that have one social consequence or dependency symptom, an effective method of intervention comes in the form of reducing the

amount of alcohol they consume (Walitzer & Connors, 1999). Jessica Crounce and Mary Larimer explore the components of a typical intervention process, and categorize interventions into “three broad categories: educational/awareness, cognitive/behavioral skills-based, and motivational/feedback-based” (Crounce & Larimer 2007). In comparison to the amount of research and development into the alcohol abuse intervention technologies themselves, the amount of research put into finding the attitudes that people hold regarding the use of said technologies is remarkably low. A phone survey of over a thousand households inquired about the use of technology in preventing the operation of vehicles while under the influence of alcohol. In this study, over 80% of respondents were in favor of requiring that the vehicles of convicted drunk drivers include interlock devices, and over 60% of respondents were in favor of the interlock being installed in all vehicles if realistically possible. In three other surveys 58%, 37%, and 56% of the respondents had similar opinions regarding different but similar devices. These surveys were conducted by McInturff & Harrington, AAA Foundation for Traffic Safety, and EKOS Research Associates, respectively (Walitzer & Connors, 1999).

Methodology

This project assessed the receptiveness of college age students to using technology devices for binge drinking intervention using focus groups and a survey. First a list representative of the various technologies and products currently available or currently in development was generated. This list was generated by searching through digital marketplaces as well as peer reviewed articles using keywords such as alcohol, management, and intervention. The generated list of technologies were then presented as a slideshow presentation to a series of focus groups. The goal of the focus groups was to obtain feedback regarding the technologies. Following the focus groups, the recorded attitudes and opinions of the subjects toward the

presented technologies were used to write a list of survey, which was used to quantify the opinions learned from the focus group subjects across a larger population.

Results and Analysis

The findings from the two focus groups and a survey shed light on the opinions college aged users may have in regards to binge-drinking intervention technologies. Two focus groups were conducted with the purpose of discerning general opinions and concerns towards the twelve drinking intervention technologies that were researched earlier. The general opinions portrayed during the focus group are as follows:

- Users were concerned by the accuracy and ease of use of the devices.
- Lighter drinkers were concerned by the possibility of social stigmas surrounding problem drinking, and therefore valued security and privacy.
- Technologies that analyze patterns over time were seen as more likely to be able to intervene and prevent binge drinking.
- There was an interest of incorporating multiple functions or features into multi-functional devices or applications.
- Subjects felt that the technologies were valuable and important, but they were not necessary or appropriate for people who are not “problem drinkers,” or people who would be classified as alcoholics.

Using these findings, the team designed a survey that was used to quantify the thoughts that were displayed during the focus group. The survey consisted of a participant demographic section, and sections to quantify user feelings towards specific binge drinking intervention technologies and their use cases. Unfortunately, the time restraints prevented the survey from gathering enough participants to get significant findings. The findings from the survey are as follows:

- A technology's analyses of BAC needs to be accurate
- Perceptions from other people regarding one's use of a technology was unimportant
- Most of the assessed technologies were seen as having the possibility of reducing binge drinking behavior.
- Respondents agreed that most of the technologies would not be used in bars or parties.
- Device simplicity and ease of use were the favored characteristics.
- The most appealing technologies were smartwatch applications and portable breathalyzers.

Conclusion

From the results produced by the focus groups and the survey that were conducted, some conclusions were drawn about the attitudes college age drinkers had regarding technological intervention for binge drinking. The conclusions were that college students were greatly concerned with the accuracy of the various devices. There were several new, untested technologies and the respondents were skeptical of their accuracy. Another finding was that the subjects preferred technologies that operated automatically or when the user wanted. Automatic devices required little effort from their users and thus were easy to use. Conversely, devices used voluntarily avoided annoying warnings or dedicated effort and provided instantaneous results. Finally, the subjects showed little concern for the perceptions other people had of them regarding their use of alcohol intervention devices.

1-Introduction

Excessive consumption of alcohol, such as binge-drinking, is a major, growing concern in the population overall, as well as a particular concern in the youth of college campuses in the United States. The Center for Disease Control (CDC, 2016) defines binge drinking or heavy episodic drinking as 5 or more drinks for men and 4 or more drinks for women in approximately a two hour timeframe. The idea that binge drinking is considered consuming a large amount of alcohol in one sitting is actually a more recent concept. (Gmel et al, 2010). More traditionally binge drinking would be considered the consumption of a large amount of alcohol over a period of several days. This more recent definition is associated with high Blood Alcohol Concentrations (BAC) that result from consuming large amounts of alcohol in one sitting (Gmel et al, 2010). The CDC goes on to define one drink as 12 ounces of beer, 4 ounces of wine, or 1.5 ounces of 80 proof alcohol (CDC, 2016). Almost half of college students in a survey of 17,592 participants were classified as binge drinkers (Wechsler et al, 1995).

1-1-Alcohol and Binge Drinking Statistics

Approximately 100,000 Americans die annually as a direct or indirect result of alcohol abuse (McGinnis & Foege, 1993). In addition, a study from 2003 showed that between 1993 and 2001, the per capita incidence of binge-drinking in US adults increased by 17% (Naimi et al, 2003). Despite the potentially severe consequences, binge drinking is a very common occurrence among the United States adult population. The study completed by Naimi et al, along with many others, illustrates the scale and continued growth of a serious problem among the population. Of more relevance to this project is the rate of binge drinking among US college students. A survey conducted at four year university using a questionnaire detailing drinking

habits found that forty-four percent of respondents were considered binge drinkers (Wechsler et al, 1995). Another survey conducted by the National Institute on Alcohol Abuse and Alcoholism across the United States corroborates this claim with data finding that 60% of college students aged 18-22 drink alcohol, with 2/3 of those respondents also engaging in binge drinking, resulting in a 40% incidence of binge drinking among the surveyed population. These studies bring to light the severity of the public health issue that is affecting the young people of the United States' collegiate community.

1-2-Alcohol Interventions

There is a long history in the management of alcoholism and rehabilitation due to alcohol abuse. Literature of various programs dating as far back as 1969, illustrate the effectiveness of counseling, therapy, and drugs in curbing alcohol abuse.(Jones & Vischi, 1979) The well-known group Alcoholics Anonymous, has also operated since 1935, two years following the end of the U.S.'s alcohol Prohibition era. These traditional methods, while tried and true, fail to factor in the unique circumstances of contemporary youths. One such example is the smartphone, a piece of technology that is quite commonplace today. Research is being done to test if this device's sensors can detect motor skill impairment from gait patterns as well as BAC from your skin (Arnold et al, 2015). Current college-aged students have had the opportunity to witness the creation of an age of technological ubiquity, and yet there has been a lack of research into the opinions and concerns of this unique demographic in regards to the rapidly expanding space of technological research and development.

1-3-Understanding Binge Drinking and its Effects

The effects of binge drinking can be both long term and short term (Gmel et al, 2010). and depend t on how frequently a person participates in binge drinking. In a study considering: 1.) individuals who had started binge drinking during adolescence and continued to binge drink at a consistent frequency into their mid-twenties and 2.) individuals who started binge drinking in adolescence and increased frequency into their mid-twenties, similar results were accumulated in terms of long term effects. These similar results included higher prevalence of antisocial personality disorder and delinquency when compared to individuals who had been binge drinking since adolescence at a much lower frequency (Gmel et al, 2010). In general, heavy consumption of alcohol is associated with higher mortality rates (Kauhanen et al, 1997). On a larger scale, binge drinking is correlated to crime rates, violence, road fatalities and other negative societal consequences (Srivastava, 2010). Another issue that may arise from excessive drinking is breathing and choking problems, especially when asleep. Hemodialysis may also be used in severe cases, or when methanol or isopropyl alcohol is ingested. (Mayo Clinic Staff, 2016)

1-4-Types of Technology

The most common commercial products at the moment fall into two main categories: breathalyzers and BAC estimators. Breathalyzers, whether portable are integrated into an automobile's ignition interlock, uses a variety of body sensors to measure a person's BAC. Similarly, BAC estimators also seek to quantify a person's BAC, however, instead of doing so directly through sensors, this category of devices uses cheaper methods to infer similar data, usually involving calculations of a person's alcohol intake, size, and gender. These technologies represent the largest proportion of alcohol intervention technologies. There were however, other

technologies, usually not on the market but still in development, that utilized more esoteric methods of inferring one's level of intoxication. Some of these alternate methods included dexterity, coordination, and motor skill tests, the use of motion sensors to detect changes in gait, as well as skin and heartrate sensors to calculate BAC.

1-5-The Goal of this IQP

The goal of this project was to investigate the positive and negative thoughts, as well as the general feelings that drinking-age college students have towards various alcohol abuse intervention technologies. A majority of existing binge drinking intervention technologies are either in development, or the attitudes of their consumers are not thoroughly researched. Through analyzing attitudes about particular technologies, the potential for new and improved technologies can be further explored. Our methodology involved holding a number of focus groups with the target population, college students, in which they were presented with examples of technologies on the market or in development. Their feedback and some general demographic information was recorded. Afterwards, a survey was constructed using the feedback from focus groups. The purpose of the survey was to quantify the scope and severity of issues brought up during the focus groups. The survey was also expected to be further reaching than the focus groups, with access to larger populations, which would allow for conclusions about the thoughts of college students in general. Ultimately, this project attempted to uncover features and/or usage methods which would appeal to, and be realistically used by college-age end users of such technologies. With this information, an ideal technology, one which is more successful than previous methods of intervening in binge drinking, could be created.

2-Background and Related Work

This chapter serves as a review of the topics and information relevant to understanding the execution and context of this project. The chapter consists of an overview of methods of intervention used to control unhealthy drinking habits, related works, and existing technologies.

2-1-Types of Interventions

In order to better understand how effective a specific technological intervention may be, it is important to identify which category of intervention it fits into, and understand the strengths and weaknesses of said category.

2-2-Non-Technology Based Interventions

The most common methods of intervening in problem drinking are non-technologically based methods. Among problem drinkers, those that have one social consequence or dependency symptom, an effective method of intervention comes in the form of reducing the amount of alcohol they consume (Walitzer & Connors, 1999). This can take the form of either a reduction program, where alcohol is still consumed but at a lesser level, or an abstinence program, where no more alcohol is consumed. Either of these programs are completed following many of the same steps including “self-monitoring, goal setting, functional analysis of drinking behavior, learning to respond differently to situations that are associated with drinking , and strategies for modifying drinking behavior” (Walitzer & Connors, 1999). These strategies have had some level of success. From Walitzer & Connors, follow ups with individuals using these strategies showed that 23% stopped drinking completely, 14% had “no drinking related” issues,

and 22% still experienced some problems but at a lower rate than before, and 35% had the same problems as they originally did prior to the study.

It is important to identify what different types of intervention there are, and how they differ from each other. Jessica Cronce and Mary Larimer explore the components of a typical intervention process, and categorize different interventions by their methods. There are different ways of implementing the components of an intervention into a successful intervention method, each method with its own advantages and disadvantages. These can be broken down into “three broad categories: educational/awareness, cognitive/behavioral skills-based, and motivational/feedback-based” (Cronce & Larimer 2007).

Educational and awareness intervention programs can be subdivided into three categories: information and knowledge programs, values clarification programs, and normative re-education programs. Information and knowledge programs are simply programs which include informing participants on risks of drinking, drinking statistics, and/or advice to prevent unhealthy drinking habits. These programs commonly use pamphlets and letters, and focus on reaching the largest number of people possible. Values clarification programs involve getting a person to identify what is valuable to them, and showing them how harmful drinking habits can negatively affect these values. Normative re-education programs involve comparing a subject's personal actions and habits to those of an average person. Of the three educational and awareness programs, normative re-education tended to be the most effective at reducing harmful drinking habits, but they all tended to have a low impact when not used in conjunction with other intervention methods (Cronce & Larimer 2007).

Cognitive and behavioral skills-based intervention programs can also be subdivided into three categories: alcohol specific skills, multi-component alcohol skills, and general life skills.

Alcohol specific skills interventions can consist of either challenging an individual's expectations on normal drinking habits, or getting an individual to monitor, evaluate, and sometimes set goals in regards to their own alcohol consumption habits. Multi-component alcohol skills interventions combine alcohol specific skills interventions with any number of related skills training, such as general lifestyle training. General life skills interventions do not specifically focus on alcohol skills, but may result in a reduction of unhealthy drinking habits in order to promote a healthy lifestyle (Cronce & Larimer 2007).

Motivational and feedback-based intervention programs can be subdivided into two categories: brief motivational interventions and mailed or computerized motivational feedback. The former category can be implemented in a plethora of different ways, and is only distinguishable in that the interventions focus on getting the participants motivated to change their behavior. Because of that, this approach is very versatile. The latter category, mailed or computerized motivational feedback, is similar to the educational and awareness interventions, but with a focus on getting a person to adopt healthy drinking habits (Cronce & Larimer 2007).

2-3-Technology Based Interventions

Technological interventions are newer than their non-technology counterparts, and their possibilities are still being explored and tested. Some of these interventions perform the same role as non-technological ones, such as e-mail delivery of intervention materials in comparison to postage based delivery of the material (Moore, 2005). Other technological interventions try out new approaches made possible by the nature of the technology. For example, a website called My Student Body uses the internet to connect students and teach them ways to prevent risky drinking at a scale that could not be achieved by non-technological means (Chiauzzi et al. 2005). Another new possibility brought about by technological interventions is in-the-moment

intervention. Traditional interventions work off of identifying a pattern of behavior causing risky drinking, but with technology based interventions it is possible to identify risky drinking behavior and immediately intervene during the act of drinking. While some of the technological interventions are in place, there are many more that are still in development and being tested. This paper will attempt to identify possible concerns college students may have with some of the features, applications, and functions of various intervention technologies.

This paper will focus on the relatively new technology based methods of intervention in order to evaluate how effective they would be in a college setting. Depending on their approaches, technology based interventions may fit into different categories of interventions, and in some cases an intervention may fit into multiple categories.

2-4-Related Works

In comparison to the amount of research and development into the alcohol abuse intervention technologies themselves, the amount of research put into finding the attitudes that people hold regarding the use of said technologies is remarkably low. A phone survey of over a thousand households inquired about the use of technology in preventing the operation of vehicles while under the influence of alcohol (Mccartt et al, 2008). In this study, over 80% of respondents were in favor of requiring the vehicles of convicted drunk drivers include interlock devices, and over 60% of respondents were in favor of the interlock being installed in all vehicles if realistically possible. In three other surveys cited in the article 58%, 37%, and 56% of the respondents had similar opinion regarding different but similar devices. These surveys were conducted by McInturff & Harrington, AAA Foundation for Traffic Safety, and EKOS Research Associates, respectively.

There have been other studies and efforts that categorized drinking related applications (apps) for smartphones in accordance with what these apps accomplish. Weaver et al surveyed both the iTunes and Android app stores, using terms such as ‘alcohol’ as search parameters to identify apps to be examined. After pinpointing these apps, the researchers set about categorizing each app into relevant subgroups: entertainment, bar finders, drink recipe sources, BAC calculators, and health promoting apps. Of the 384 apps identified by researchers, approximately half were entertainment, bar finders, and drink recipe identifiers, 36% were BAC calculators, and the remainder were health related apps. After identifying these applications, the researchers conducted focus groups with “young people” to catalogue their responses to these apps. For the most part, the participants communicated to the researchers that the BAC apps were seen as games, and there were concerns regarding the accuracy of the BAC with the data provided. The participants thought that the more useful apps would be the ones that provided information and quick or easy access to services while intoxicated. (Weaver et al, 2013) Another study also used focus groups to design a phone app using a mobile social networking tool to moderate alcohol consumption. Approximately 767 alcohol use applications on iTunes app store were evaluated and categorized based on their purposes. Researchers used this information to design a proposed mobile social tool to moderate alcohol consumption. The researchers then performed focus groups with 14 young women to review and discuss the effectiveness of their proposed design. The app combines many features ranging from entertainment, communication, and social networking. It was important that the app be fun and practical to use. In order to achieve this, the app relied on social normative feedback to control its users drinking habits behind standard inconspicuous features such as timelines and event sharing. 10 of the 14 participants reacted negatively to the drink monitoring feature of the app since it was perceived

as troublesome and impractical to use during real drinking situations (Tjondronegoro et al., 2015). In another study, McNally et al illustrates conventional, non-technology based methods of intervention by researching the possibility of administering brief motivational interventions to mixed groups of drinking and non-drinking students. The study consisted of 76 participants recruited from introductory psychology courses with a minimum age of 18. The subjects participated in a two-session study consisting of a self-report of drinking-related variables and a group intervention. There were three different studies: Actual-Ideal Discrepancy Intervention, Self-Norm Discrepancy Intervention, and a Control Group. It was found that the Self-Normative interventions were most effective at reducing heavy drinking frequency (McNally & Palfai, 2003).

2-5- Existing Technologies

Despite the relative infancy of technology based drinking interventions, there is still a decent number of technologies that provide this service. For the purpose of this project, multiple types of technologies were researched to give the participants a wide range of products to consider. Existing technologies were researched from online databases and device markets such as the Apple AppStore and Google Play. The various technologies that are either currently commercially available or in development were diverse, ranging from a multitude of simple drink recorders or BAC estimators to technologies that use both the dermal and motion sensors from cellular devices in order to detect inebriation in their users. Although the diversity in the current technologies is very broad, they could generally be classified into 3 main categories. These categories are: applications for existing devices, standalone devices, and technologies in development. This research not only familiarized the project team with current developments and products in the area of research, but also served as the foundation for the next stage of the

project which will be detailed further in the methodology. Table 1 below lists the technologies researched by the group. Table 1 is followed by Table 2 that sorts the technologies into the five categories BAC estimators, BAC analyzers, drink recorders, alcohol support resources, and finally auxiliary technologies.

Table 1: List of Researched Technologies

Name	Creator	Description	Intervention Time Frame
Location-Based Monitoring and Intervention System for Alcohol use disorders	University of Alaska	Warns user when approaching sites of past binge-drinking via GPS	In-the-moment
Phone-based Gait Analysis to Detect Alcohol Usage	Worcester Polytechnic Institute	Monitors change in gait to detect intoxication	In-the-moment
Driver Ignition Interlock	D S Edmonds, III, J W Hopta	Detects BAC from skin contact	In-the-moment
"Smartwatch app"	University of Texas	Monitors heart rate and skin temperature to detect intoxication	In-the-moment
Soberlink	Soberlink	Detects BAC from exhaled breath	After drinking
Lifeguard	Lifeloc Technologies Inc.	Detects BAC from exhaled breath	After drinking
MyStudentBody	Hazelden Publishing	Teaches negative health consequences of alcohol abuse	Long-term drinking review
Blood Alcohol Calculator with Dexterity Test	Appy Guys LLC	Estimates BAC from consumed drinks, Tests dexterity with game	After drinking
Recovered Podcast	Wizzard Media	Provides audio resources to prevent binge drinking	Long-term drinking review
Drink.app	Fun Touch Apps	Estimates BAC from consumed drinks, creates visual aids to interpret past drinking habits	After drinking
Step Away	Here and Now Systems	Provides feedback and other alcohol avoidance strategies	Long-term drinking review
Alcometer	Umer Malik	Estimates BAC from consumed drinks, Tests dexterity and mental acuity using games	After drinking
AlcoChange	CyberLiver	Detects BAC from exhaled breath	After drinking
SoberApp	GoFirst	Estimates BAC from consumed drinks, provides normative feedback from social media	After drinking
Alcohol Test Free	Icarus	Estimates BAC from consumed drinks, provides easy access to emergency contacts and services	After drinking
Alcohol Tester	EvolutionApps	Estimates BAC from consumed drinks, Tests dexterity with game	After drinking

BarTab Keepr	AE'G-wiz	Monitors monetary cost of drinking	After drinking
iDrinkSmarter	BACZONE, LLC	Estimates and predicts BAC, provides normative feedback via networking among friends	After drinking

Table 2: Categorized Technologies

BAC Estimators	BAC Analyzers	Drink Recorders
BAC Calculator w/ Dexterity Test	**Driver Ignition Interlock	SoberApp
Drink.app	Lifeguard	Alcohol Test Free
Alcometer	Soberlink	BarTab Keepr
Alcohol Tester	***"Smartwatch App"	
iDrinkSmarter	AlcoChange	
Alcohol Support Resources	Auxiliary Technologies	
MyStudentBody	**Location-based monitoring & Intervention System	**Provides Active Intervention
Recovered Podcast	**Phone-based Gait Analysis	
Step Away		

Location-Based Monitoring and Intervention System for Alcohol Disorders (LMBI-A)

LMBI-A is a program being researched for use with cell phones. The program uses the GPS technology that comes with many modern cellular devices to track the user's location and give them warnings when they enter sites where previous alcohol abuse had been recorded since they first started using the program (Patrick et al 2013).

Intoxication Detection from Gait

Additional research into cell phone based technologies is also being conducted by the National Taiwan University (Kao et al 2012) and further developed by Worcester Polytechnic Institute (Arnold, 2015) in the use of motion detection. Both universities studied the application of a cell phone's accelerometer, a technology normally used to detect the phone's orientation and rotate screens, in order to detect changes in the user's walking patterns to determine their level of intoxication.

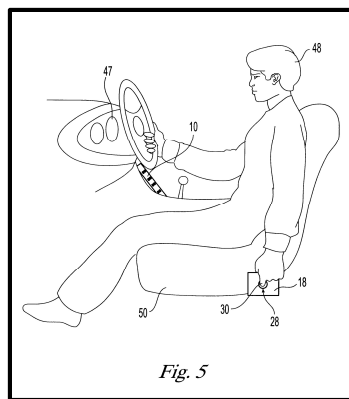


Figure 1: Diagram of the fingerprint interlock

Ignition Interlocks

Ignition interlock devices are a type of technology fit onto automobiles, requiring the driver to pass a BAC test before operating the vehicle. Traditionally, the test is performed using a breathalyzer, but as illustrated in Figure 1, there are also others that require a fingerprint and detect your BAC through skin contact (Edmonds et al., 2001). (Edmonds et al., 2001)

Smartwatch Monitoring

Health technologies such as smartwatches can also be used to combat alcohol abuse. Similar to the previously mentioned interlock device, an smartwatch app designed by the University of Texas uses its sensors to monitor your heart rate and skin temperature in order to detect the wearer's level of intoxication. The app will also alert the user when they reach a certain intoxication threshold (Gutierrez et al, 2015).



Figure 2: Soberlink Breathalyzer

Breathalyzers

A variety of technologies that are used to manage binge-drinking can be classified as a breathalyzer. Figure 2 depicts this type of device analyzes the user's breath after drinking to measure and present their BAC. Devices such as Lifeguard, Soberlink, and Alcochange fall under this category. Compared to breathalyzers that are integrated into ignition interlocks, these devices are portable. Soberlink requires a photo verification of the user in addition to the normal breathalyzer test, and alerts them to missed tests (Lifeloc Technologies Inc, n.d.) (Soberlink, 2016) (.AlcoChange, n.d.) (Soberlink, 2016)

Smartphone Applications

This final category of technologies is also the most broad category. This category is comprised of smartphone apps that don't utilize any sensor technologies to detect or measure intoxication.

3-Methodology

The main goal of this IQP was to determine the receptiveness of drinking-age, college students towards using technological devices and applications in order to track and prevent binge drinking. Alcohol intervention has a long history, but the techniques and strategies to combat unhealthy drinking behavior have not been keeping up with the recent strides in technology. New advances and discoveries have opened up new possibilities for intervention. To this end, the team started the project by determining which drinking intervention technologies were currently available, currently in development, or at the conceptual stage. Following this, the team conducted a series of focus groups and informed participants of some of the new developments in alcohol intervention. After introducing these technologies, the team attempted to elicit the participants' concerns and opinions regarding these devices. The project then culminated with a survey that sought to quantify the attitudes of drinking-age WPI students with respect to the concepts of the binge-drinking intervention technologies that were discussed with the focus group participants.

3-1-Research of new and existing technologies

The first step of the project involved researching current products and technologies used for alcohol intervention. These devices, applications, and technologies were used to create a list that was presented to focus groups. Care was taken to include a wide variety of the many types of technology based intervention methods. Since this project revolved around researching the opinions of students toward the feasibility of using technology to intervene in unhealthy drinking habits, it was paramount that a diverse list of technologies be generated so that a large scope of possible technology applications be covered. For the purposes of this project, this spectrum was comprised of smartphone apps, computer programs or services, and other standalone devices or

technologies. The devices and technologies found for inclusion were categorized by two primary methods. Entries that were commercially available, especially smartphone apps, were found by browsing markets with keywords such as ‘alcohol intervention’ and ‘BAC’. The second method involved using keywords similar to those in the previous method to search peer reviewed articles. Once appropriate articles were found, the technologies referred to in the article were researched and included in the list.

3-2-Conducting the focus group

After generating a list of technologies, the project conducted a series of focus groups to present the technologies to the target demographic. The focus group was advertised to subjects in the Social Science Participant Pool (SONA) . This program is part of a class in which students receive academic credit for participating in user studies. SONA is used by WPI to recruit students for different kinds of studies, with many studies giving participants credit for their courses. This means that no external incentive was given by the team, as the participants already had an incentive to participate in the study. The potential participants for this focus group were screened predominantly by age. Since the topic of the study was alcohol consumption, we were seeking participants of at least 21-years-old, the legal drinking age of the U.S. In addition, since the SONA system is utilized by college students, the target demographic, they were the participants.

Upon entering the focus group each participant was given an a sequential ID number to be referenced by the researchers and other participants. In addition, before the focus group fully commenced, each participant was asked to fill out a short demographic survey. The survey asked the participants about their age, gender, and drinking habits. By assigning ID numbers to each individual person, the team minimized the risk of releasing any potentially damaging

information, as this ID number was the only link between the participant and his/her comments during the survey. The focus groups took the form of a simple slideshow presentation that introduced the project and binge-drinking intervention technologies to the participants, and followed with questions to elicit feedback from the participants. The questions were generally geared toward identifying the concerns and opinions of the participants with the particular pieces of technology, their likelihood of use, their convenience of use, their intrusion on everyday life, and their preferred price range. The responses given by the participants were recorded by the project members manually. The presentation and focus group was planned to take no more than one hour, and as such approximately a dozen technologies were covered with 3-4 examples of each category of technology.

3-3-Conducting the survey

Following the focus groups described previously, the team chose to gather quantitative data from a wider sample population via a survey. The survey followed after the focus group because the information gathered during these sessions helped to generate an effective survey. This allowed the team to quantify the qualitative results from the focus groups. The survey was administered anonymously to WPI students who identified as at least 21-years-old. Potential candidates that did not meet this age requirement were screened out by SONA automatically by indicating that we only wanted participants that were at or above the age of 21 as subjects. The purpose of limiting the survey to students over the age of 21 was to reach the heart of the issue the team was trying to answer. The students that chose to drink and were under the legal age could have different concerns regarding using technology to monitor or intervene during heavy drinking sessions, which may skew the results or lead to an inaccurate representation of reality. The survey was posted on SONA and used the survey system Qualtrics, allowing for a large

participant pool and no need for the team to give an incentive. Qualtrics easily allows for the participants to take the survey while still remaining anonymous.

The survey was structured in three sections. The first section contained questions asking for the participants' age and gender. This information was used to help organize and analyze the data gathered by the ensuing questions. As this investigation focused on intervention for heavy drinking and/or binge drinking, the survey needed to have a set of screening questions to sort out the participants and their responses. This was accomplished in the second section of the survey, where questions were asked regarding the participant's drinking habits. The third and final section used the information from the focus groups. Here, questions regarding the receptiveness of using technology as a means of intervening during binge drinking or heavy drinking are asked. Using data from the focus groups, questions were formulated to gather quantitative information and draw conclusions regarding attitudes towards the use of technology for controlling or monitoring alcohol consumption. With WPI's undergraduate population of approximately 4000 students as well as a 10% margin of error and 90% confidence level, formula 1 below showed that at least 67 subjects should respond to the survey in order to draw appropriate conclusions (Rumsey, D., 2011).

$$ME = z \sqrt{.5 * .5/n}, ME = \text{Margin of error}, z = z - \text{score for confidence level}, n = \text{sample size}$$

Formula 1: Sample Size Calculation

$$0.1 = 1.645 \sqrt{.25/n}, n = 67$$

4-Results and Analysis

The following sections present the findings made as a result of the studies conducted for this project. Together, the findings from both the focus groups and the survey shed light on the opinions college aged users may have in regards to binge-drinking intervention technologies.

4-1-Focus Group Results and Analysis

The 10 subjects from the two focus groups gave a wide range of opinions encompassing multiple alcohol consumption patterns. The demographic breakdown of the focus group participants were as follows: 6/10 of the participants were female, and 9/10 were 21 or 22 years old. A majority, 8/10, of the subjects had consumed alcohol within two weeks of the focus group. Three of the subject reported never having binge drank, and five participants reported bingeing within two weeks of the focus group. A summary of the demographic information of the subjects from the focus group is provided below in Tables 3 as well as Figures 3 & 4.

Table 3: Focus Group Subject Demographic Data

Age	Currently Enrolled as:	Gender	Last Time Subject Consumed Alcohol	Last Time Subject Binged	Frequency of Use of Cell phone	Frequency of Use of Email	Frequency of Use of Smartwatch	Frequency of Use of Laptop	Frequency of Use of Tablet
21	Junior	Male	1 to 2 Weeks	1 to 2 Weeks	Every Half Hour	Daily	Never	Hourly	Never
21	Senior	Female	1 to 2 Weeks	1 to 2 Weeks	Hourly	Hourly	Never	Daily	Never
21	Junior	Male	1 to 2 Weeks	1 to 2 Weeks	A Lot	Daily	Never	Always	Never
22	Senior	Male	1+ Months	Never	Daily	Daily	Never	Daily	Daily
22	Junior	Male	Never	Never	Every 10 Minutes	Daily	Never	Constantly	Never
22	Senior	Female	1 to 2 Weeks	Never	Daily	Daily	Never	Daily	Weekly
21	Junior	Female	0 to 1 Weeks	3 to 4 Weeks	Daily	Daily	Daily	Daily	Never
22	Senior	Female	0 to 1 Weeks	1 to 2 Weeks	Daily	Daily	Never	Daily	1+ Months
22	Senior	Female	0 to 1 Weeks	1 to 2 Weeks	Daily	Daily	Never	Daily	Never
61	Other	Female	0 to 1 Weeks	1+ Months	Daily	Daily	Never	Weekly	Daily

Figure 3: Frequency of Alcohol Consumptions for Focus Group Subjects

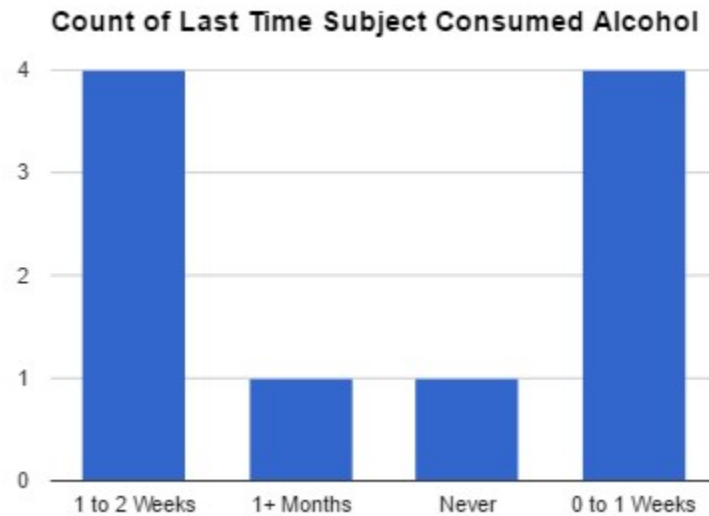
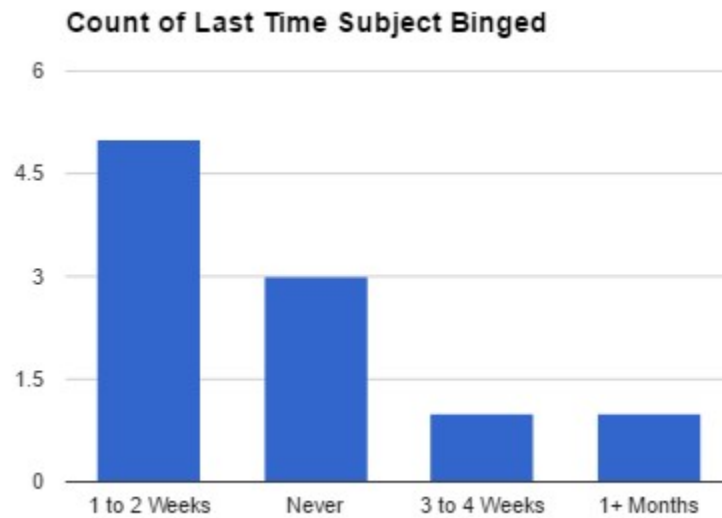


Figure 4: Frequency of Binge Drinking for Focus Group Subjects



The following list indicates the general reactions from participants toward the technologies that were described during the focus group.

iDrinkSmarter

- Inconvenience of use while drinking
- Skepticism toward accuracy
- Desire for more automation

SoberApp

- Barcode feature may not be convenient enough, especially in crowded/busy settings.
- Taxi hailing feature was appreciated
- Social media feature was not well received for harm to social standing

BarTabKeeper

- Applicable mostly in bars.
- Non-health related reminder
- Does not shame a person's drinking habits

Smartwatch

- Cost of technology may deter users
- Does not integrate as easily to existing technology, ie smartphones
- Praised automatic monitoring/warning

MyStudentBody

- Does not see casual use
- Little incentive for long term use
- Requires user to be aware of their drinking to use
- Should implement a reminder incentive continued use

Intoxication Detection from Gait

- Not walking while drinking
- Gait analysis may be affected by phone placement, ie bag, hand, pocket, etc
- Does not intervene with binge drinking only detects

Location Based Monitoring and Intervention for Alcohol Use

- Mostly helpful for serious drinkers, ie alcoholics or abstainers
- Can increase drinking

Fingerprint

- Doesn't prevent binge drinking
- Would rather call taxi/uber when drinking
- May impede sober usage of car

Soberlink

- Not necessary for casual drinkers

AlcoChange

- Requires phone, which may or may not be used while drinking
- Risk of tampering or losing device
- Simple implementation of a portable breathalyzer
- Social stigma

The findings regarding the attitudes of college-age drinkers toward binge drinking technologies produced some trends across the technologies. It was found that users were concerned by the accuracy and ease of use of the devices. One subject doubted the ability of BAC estimators to provide accurate results. Other subjects had reservations for some of the newer technologies such as smartwatch sensors and smartphone gait inference. Assuming the technologies were accurate, the next point of interest for the subjects was that operate automatically were also preferred by the majority of students. There was an approximate split in the focus group subjects on whether they actively used devices such as their smartphone while they drank. However, there was consensus between the two groups that distracting or difficult to use features such as manual input of drinks for many BAC estimators would deter them from using an intervention device. Technologies that analyze patterns over time were seen as more likely to be able to intervene and prevent binge drinking. Not only would they be easier to use, but they would actually avoid the user becoming drunk. Unless used frequently breathalyzers and interlocks only provide a one-time measurement of the user's intoxication. Another finding was that lighter drinkers were concerned by the possibility of social stigmas surrounding problem drinking, and therefore value security and privacy. As an example, one subject thought that the social media share button on the SoberApp BAC estimator was dangerously close to its find a taxi button. The subject was concerned a mistaken press of the button, intoxicated or sober, would lead to sensitive information being unintentionally revealed. Another subject balked at the notion of even including a share feature for such a device. After reviewing several technologies, there was an interest of incorporating individual functions or features into multi-functional devices or applications. The subjects appreciated aspects of the various technologies presented to them, and pondered whether or not it would be possible to integrate many, if not all of them, into

a singular device or application. Finally, subjects felt that the technologies were valuable and important, but they were not necessary or appropriate for people who are not “problem drinkers,” people who would be classified as alcoholics. For the purposes of study, lighter drinkers are classed as drinkers that have not binged within the last 1-2 weeks in contrast to heavier drinkers that have binged within 1-2 weeks.

4-1-1-Device accuracy

The accuracy of each device was brought up numerous times for a majority of the presented products. In general, the members of the focus group were concerned that the devices could not accurately determine a person’s BAC. At the start of one focus group, a subject shared their opinion that intoxication detection or measurement devices provided at best only estimates, and at worst the devices were wholly inaccurate. Another subject criticized using BAC detection technology on the Smartwatch for what he cited as known flaws in the sensors used to calculate BAC. A third subject was wary of the ignition interlock using a fingerprint breathalyzer due to its less proven accuracy compared to breathalyzers. Half of the subjects were skeptical of the ability of the gait based inference technology to accurately identify changes in a person’s walking pattern due to the effects of intoxication.

4-1-2-Ease of use

Another issue for BAC estimators regarded how difficult they were to use. Most of the phone app based technologies required manual input of alcohol consumed. Many subjects found that this aspect hindered the usability of the apps, especially in real drinking situations such as bars or parties. This also applied to holistic drinking history monitors, such as MyStudentBody. Easier to use features, such as the barcode drink identification used by SoberApp, were well

received in comparison to manual input of drinks. However, the participants brought up issues with the ability to obtain barcodes, especially in a busy bar. Heavier drinking subjects shared that they would be more receptive to a technology if it were more proactive or simple. As a result, heavier drinkers showed a greater affinity for technologies such as the Smartwatch app and Gait inference technology. Because these devices passively detect changes in their users, they are able to perform analyses or provide intervention without requiring user interaction.

4-1-3-Privacy Concerns

The need for privacy and inconspicuousness of use was a concern brought up by lighter drinkers, but was not generally echoed by their more heavy drinking peers. The lighter drinking subjects were sensitive to potential social stigma regarding perceived problem drinking habits. This sensitivity manifested in reservations toward using some of the products. For example, a number of the BAC estimators used normative feedback through social media as a way to curb excessive drinking, and most subjects were worried that these features would damage their social standing or employability if their drinking habits were made public on social media platforms. There was concern that the interfaces of devices might lead to unintentionally sharing information. The app iDrinkSmarter demonstrated this concern due to its share button being placed close to other features. The subjects were concerned that accidental button presses, especially while drunk, would lead to damaging information being released. The subjects also suggested that password protection be used for one app, BarTabKeeper, so that the amount one has spent on alcohol would be kept private. In addition, the the ability to be easily seen using many of these devices was enough to deter interest in using them. This resulted in the stand alone devices, such as portable breathalyzers and purpose built smartwatches, being unpopular.

4-1-4-Ability to Intervene

While the subjects acknowledged the potential benefits of many of the technologies presented, certain devices were perceived as not being capable to intervene and prevent binge drinking. This fault was shared by MyStudentBody, the ignition interlock, and the gait inference app. There was little incentive or reminders for subjects to use MyStudentBody, especially over a long period of time. Since this program asks users to record their drinking after the fact, it does nothing to intervene with binge drinking. A similar problem exists for interlocks. Since one would not approach their vehicle during the act of drinking, it wouldn't be until they already become intoxicated that an interlock comes into use. At that point, one has already binged. In addition, the subjects felt that this problem also exists for the gait inference technology, since many of the subjects responded that they drank in sedentary positions. As a result, the technology wouldn't be able to perform its analysis until after binge drinking had occurred. In contrast, breathalyzers and BAC calculators provide results to their user in the moment of use, and thus actually provide intervention during a drinking session.

4-1-5-Multi-functionality

The subjects displayed a desire for multi-functional apps or devices that combined a variety of features and services instead of relying on single gimmicks or functions. Subjects expressed a preference for development on existing platforms, such as the GooglePlay or iTunes for Android and Apple mobile devices respectively, as opposed to stand-alone devices. This finding shares some overlap with the previous finding. An app or device with a variety of features may appear more socially acceptable than one solely dedicated to behavioral management, suggesting that its user has drinking problems. This preference is illustrated by a subject's suggestion that the function of the BarTabKeepr app be rolled into other applications.

A budget keeping program is fairly simple to create, and there are hundreds available on a variety of platforms. As such, it would be easy to integrate such functionality into a larger application. Two other subjects showed similar interest in the gait inference app. As illustrated by the list of technologies presented at the focus groups, contemporary mobile devices already have the equipment required to make a variety of analyses on their users to provide information regarding their drinking habits as well as their state of intoxication.

4-1-6-Relevance to Casual Drinkers

Finally, the last finding was that the subjects were often concerned with the relevance of some of the products in respect to the target demographic of this study. While many subjects appreciated the benefits and capabilities provided by devices such as portable breathalyzers, ignition interlocks, and location-based tracking, they felt that the technologies were more appropriate for individuals with a diagnosed alcohol disorder.

4-2-Survey Results and Analysis

The following results illustrate the results obtained from the survey. The survey sought to quantify the concerns learned from the focus groups among a greater population. However, due to the limited time allowed to gather data, the survey did not reach a sufficient number of participants to get significant findings. The responses that were received are found below.

The survey was completed by 4 people, 75% of which were 21 years of age. However, one subject did not complete the survey in its entirety. 100% of the respondents had drunk alcohol within a week of the survey, 0% of the respondents, however, had ever binged. The majority of the respondents also used common technologies, such as emails, smartphones, and computers, on a daily basis.

In regards to apps that record your drinks in order to estimate your BAC, the received responses were mixed. There was a 50/50 split in the subjects' likelihood of using this technology, as well as a 50/50 split in their perceptions of the app's ability to promote safe drinking. In contrast, respondents generally agreed in the importance for the application to be accurate, and had a lack of concern for the perceptions of others when using the application. Due to the clear division in the responses, it is difficult to produce a general conclusion about this particular type of app from these results.

In response to the prompt about a smartphone app that scans barcodes of drinks and approximates an individual's BAC based on gender, weight, and amount of drinks consumed, respondents' opinions were varied. Half of the respondents agreed that this app would help promote safe drinking, but all of the respondent disagreed with the idea that they would use this app in a drinking environment. 3/4 of respondents agreed that it is important for the app to report an accurate BAC to the user. All responses differed in terms of concerns about how the user is perceived by others for using the app. Additional responses given were mainly related to concerns regarding how realistic it would be to have a user use this app in a drinking environment. One respondent commented on a concern for the user's safety in reference to giving the user a false impression about their BAC level. If the app reports a BAC that isn't necessarily accurate, the user might act in an unsafe way, such as operating a motor vehicle while inebriated. The main concern for this app, as well as others, was the lack of accuracy, and inconvenience or unwillingness of the user to utilize the app in a drinking environment. These responses support comments recorded from both focus group sessions.

For apps that allow the user to manually input drinks in order to track both BAC and total money spent, 2/4 of the respondents were neutral in their opinion of whether they would use the

app or not, with 2/4 reporting that they disagree. Even though most respondents would not use this application, 3/4 of them said that they believed it would help promote safe drinking, and that they did not have any concerns in regards to the perceptions of others while using this app. In the text response section, one user indicated that this “is a lot of work that I feel I would quickly get tired of doing because of how drunk I feel.” This data echoes the results seen from the focus groups.

The smartwatch based BAC detector received much more positive reception in comparison to the previous technologies. 3/4 of the respondents agreed with the device’s ability to encourage moderation when drinking. In addition, 2/4 of the respondents would potentially use this device while only 1/4 of them were opposed to using this device. In a continuation of previous trends, the majority of respondents perceived accuracy as greatly important, and public perceptions as not important at 3/4 and 2/4 respectively. However, for 3/4 of the subjects cost was a major factor as to whether or not they would decide to use this product.

4-2-1-Smartphone Gait Inference

The responses for the gait based inference app were skeptical towards the viability of the device. 2/4 of responses supported the device’s use to promote healthy drinking habits, and 1/4 did not support this. The respondents agreed that this type of technology must be sufficiently accurate, with 3/4 of the responses being in agreement. Nevertheless, the responses for how likely they were to use the app and their tendency to walk while drinking provided varied results. The responses demonstrated another 50/50 split in the respondent’s receptability towards using the device.

4-2-2-LBMI-A

The LBMI-A device was met with an overall negative reaction by the survey participants. The majority, 2/3, believed that this device would not promote safe drinking. In addition, 2/3 of participants indicated that they believed the device would remind them of past drinking episodes, and would only encourage them to drink again. Another repetition, 2/3 of the participants indicated they would not use the device. As seen with most other devices, the majority of participants indicated that they were not concerned with how people would view them for using this device with 2/3 holding a neutral opinion and 1/3 showing no concern.

The next technology, a website that recorded drinking history, and provided feedback and resources to encourage safe and healthy drinking, garnered similar results as other technologies. Although the respondents understood the positive aspects the website possessed, with 3/3 of the responses agreeing that the website was able to promote safe drinking, respondents agreed that the website would be difficult to use in practical drinking situations, thus eliciting a 2/3 negative reception. Like many of the previous responses, 3/3 of the subjects showed no concern for perceptions of using the website.

4-2-3-Breathalyzers

The results from the survey in regards to breathalyzers were surprising. All of the participants agreed that these devices would help promote safe drinking. The surprising result was that 3/3 of the participants agreed they would use this device while drinking. This result is in contrast to the feedback from the focus groups. Unsurprisingly, all participants agreed that these devices need to be accurate in order to be useful, and all participants agreed that they were not concerned with how others would perceive them for using the device.

The last piece of technology that was on the survey was the ignition interlock. This device received the complete support of subjects, with 3/3 of the subjects agreeing that the interlock would be able to keep drinkers safe. This sentiment was tempered by an equal amount of subjects showing concern that such a device would cause difficulty operating a vehicle in non-drinking situations, as well as possible attempts by the user to subvert the device.

5-Conclusions

In general, it can be summarized that the principal concern subjects held was that the technologies' analyses needed to be accurate. This was supported by over two thirds of the subjects responding with a positive response for the device's accuracy. The responses indicated a similar trend in regards to outside perceptions towards the person using the device, with over two thirds of responses showing little concern for outside perceptions in 6/8 of the questions. The majority of the responses revealed that while the surveyed subjects could understand the positive health and safety benefits of the described technologies, most did not feel that the devices would be used in situations such as bars or parties. Two devices showing greater interest than the others were the smartwatch app and portable breathalyzers. One response for the breathalyzer cited its easy operation and portability allowed for discrete and convenient use to check one's level of intoxication. It can be surmised that the simplicity of the device as well as its voluntary nature contributed to its interest. Compared to technologies that recorded drinks or warned of intoxication, a breathalyzer could be utilized only when its user wants a quick measure of their BAC without considerable time, effort, or inconvenience. Similarly, the smartwatch's automated operation requires even less effort from its user, as data is gathered and analyzed passively. 2/4 of the responses indicated that subjects would consider using the app, while only 2/4 of the responses indicated that they would not. The breathalyzer had 3/3 acceptance rate. These results may illustrate that intervention style products such as the gait analysis, and ignition interlocks may not be appealing to users. It should be noted that the significance of the finding produced are lacking sufficient evidence to back them. The although the focus groups were able to produce similar, but unique responses, the survey only reached 4 participants of the expected 67 to produce statistically significant conclusions regarding WPI's campus.

References

- Arnold, Z., Larose, D., & Agu, E. (2015). *Smartphone Inference of Alcohol Consumption Levels from Gait*. Paper presented at the Healthcare Informatics (ICHI), 2015 International Conference on.
- Bardone, A. M., Krahn, D. D., Goodman, B. M., & Searles, J. S. (2000). Using interactive voice response technology and timeline follow-back methodology in studying binge eating and drinking behavior: different answers to different forms of the same question? *Addictive behaviors*, 25(1), 1-11.
- Barnett, N. P., Meade, E., & Glynn, T. R. (2014). Predictors of detection of alcohol use episodes using a transdermal alcohol sensor. *Experimental and clinical psychopharmacology*, 22(1), 86.
- Bhochhibhoya, A., Hayes, L., Branscum, P., & Taylor, L. (2015). The use of the internet for prevention of binge drinking among the college population: a systematic review of evidence. *Alcohol and alcoholism*, 50(5), 526-535.
- Center for Disease Control. (2016a). Facts sheets-Alcohol Use and Your Health. Retrieved from <http://www.cdc.gov/alcohol/fact-sheets/alcohol-use.htm>
- Center for Disease Control. (2016b). Facts sheets-Binge Drinking. Retrieved from <http://www.cdc.gov/alcohol/fact-sheets/binge-drinking.htm>
- Chiauzzi, E., Green, T. C., Lord, S., Thum, C., & Goldstein, M. (2005). My student body: a high-risk drinking prevention web site for college students. *Journal of American College Health*, 53(6), 263-274.
- Collingwood, J. (2010, 30 January, 2013). Alcohol Consumption and Genetics. *Psych Central*. Retrieved from <http://psychcentral.com/lib/alcohol-consumption-and-genetics/>
- Dimeff, L. A., Baer, J. S., Kivlahan, D. R., & Marlatt, G. A. (1999). *Brief Alcohol Screening and Intervention for College Students (Basics): A Harm Reduction Approach* (L. A. Dimeff Ed.). New York, NY: Guilford Press.
- Edmonds, D. S., & Hopta, D. W.
- Edmonds III, D. S., & Hopta, J. W. (2001). Driver alcohol ignition interlock: Google Patents.
- Gmel, G., Kuntsche, E., & Rehm, J. (2010). Risky single-occasion drinking: bingeing is not bingeing. *Addiction*, 106(6), 8.
- Gmel, G., Rehm, J., & Kuntsche, E. (2003). Binge drinking in Europe: definitions, epidemiology, and consequences. *Sucht: Zeitschrift fuer Wissenschaft und Praxis*.

- Gutierrez, M. A., Fast, M. L., Ngu, A. H., & Gao, B. J. (2015). Real-Time Prediction of Blood Alcohol Content Using Smartwatch Sensor Data *Smart Health* (pp. 175-186): Springer.
- Inc., L. T. (2016). LifeGuard Precision Fuel Cell Accuracy.
- Jones, K. R., & Vischi, T. R. (1979). Impact of alcohol, drug abuse and mental health treatment on medical care utilization: A review of the research literature. *Medical Care*, *17*(12), i-82.
- Kao1, H.-L. C., , B.-J. H., , A. C. L., & , H.-H. C., 2. (2012). Phone-based Gait Analysis to Detect Alcohol Usage (pp. 661-662). Taipei, Taiwan: Proceedings of the 2012 ACM Conference on Ubiquitous Computing.
- Kauhanen, J., Kaplan, G. A., Goldberg, D. E., & Salonen, J. T. (1997a). Beer bingeing and mortality: results from the Kuopio ischaemic heart disease risk factor study, a prospective population based study. *Bmj*, *315*(7112), 846-851.
- Kauhanen, J., Kaplan, G. A., Goldberg, D. E., & Salonen, J. T. (1997b). Beer bingeing and mortality: results from the Kuopio ischaemic heart disease risk factor study, a prospective population based study. *BMJ*, *315*, 5.
- Larimer, M. E., & Cronce, J. M. (2007a). Identification, prevention, and treatment revisited: Individual-focused college drinking prevention strategies 1999–2006. *Addictive behaviors*, *32*(11), 2439-2468.
- Larimer, M. E., & Cronce, J. M. (2007b). Identification, prevention, and treatment revisited: Individual-focused college drinking prevention strategies 1999–2006. *Addictive behaviors*, *32*(11), 2439-2468.
- Luczak, S. E., Wall, T. L., Shea, S. H., Byun, S. M., & Carr, L. G. (2001a). Binge drinking in Chinese, Korean, and White college students: Genetic and ethnic group differences. *Psychology of Addictive Behaviors*, *15*(4), 306.
- Luczak, S. E., Wall, T. L., Shea, S. H., Byun, S. M., & Carr, L. G. (2001b). Binge drinking in Chinese, Korean, and White college students: Genetic and ethnic group differences. *Psychology of Addictive Behaviors*, *15*(4), 306.
- McCartt, A. T., Wells, J. K., & Teoh, E. R. (2010). Attitudes toward in-vehicle advanced alcohol detection technology. *Traffic injury prevention*, *11*(2), 156-164.
- McGinnis, J. M., & Foege, W. H. (1993). Actual causes of death in the United States. *Jama*, *270*(18), 2207-2212.
- McNally, A. M., & Palfai, T. P. (2003). Brief group alcohol interventions with college

students: Examining motivational components. *Journal of drug education*, 33(2), 159-176.

Monti, P. M., Tevyaw, T. O. L., & Borsari, B. (2004/2005). Drinking Among Young Adults: Screening, Brief Intervention, and Outcome. *Alcohol Research and Health*, 28(4), 9.

Moore, M. J., Soderquist, J., & Werch, C. (2005). Feasibility and efficacy of a binge drinking prevention intervention for college students delivered via the Internet versus postal mail. *Journal of American College Health*, 54(1), 38-44.

Naimi, T. S., Brewer, R. D., Mokdad, A., Denny, C., Serdula, M. K., & Marks, J. S. (2003). Binge drinking among US adults. *Jama*, 289(1), 70-75.

Neumark, Y. D., Rahav, G., & Jaffe, D. H. (2003). Socio-economic status and binge drinking in Israel. *Drug and alcohol dependence*, 69(1), 15-21.

Newman, M. G., Szkodny, L. E., Llera, S. J., & Przeworski, A. (2011). A review of technology-assisted self-help and minimal contact therapies for drug and alcohol abuse and smoking addiction: Is human contact necessary for therapeutic efficacy? *Clinical Psychology Review*, 31(1), 178-186.

Patrick L. Dulin , V. M. G., Diane K. King , Danielle Giroux & , & Baco, S. (2013). Development of a Smartphone-Based, SelfAdministered Intervention System for Alcohol Use Disorders. from Taylor & Francis Group, LLC
<http://www.tandfonline.com/doi/pdf/10.1080/07347324.2013.800425>

Reich, R. R., Cummings, J. R., Greenbaum, P. E., Moltisanti, A. J., & Goldman, M. S. (2015). The temporal “pulse” of drinking: Tracking 5 years of binge drinking in emerging adults. *Journal of abnormal psychology*, 124(3), 635.

Rumsey, D. (2011). *Statistics for Deborah* (2 ed.): John Wiley & Sons.

Soberlink. (2016). Portable Breathalyzer & Alcohol Breathalyzer | SOBERLINK.

Srivastava, P. (2010). Does Bingeing Affect Earnings. *Economic Record*, 86(275), 17.

Staff, M. C. (2016). Alcohol poisoning Treatments and drugs - Mayo Clinic. Retrieved from <http://www.mayoclinic.org/diseases-conditions/alcohol-poisoning/basics/treatment/con-20029020>

Thombs, D. L., Olds, R. S., Osborn, C. J., Casseday, S., Glavin, K., & Berkowitz, A. D. (2007). Outcomes of a technology-based social norms intervention to deter alcohol use in freshman residence halls. *Journal of American College Health*, 55(6), 325-332.

- Tjondronegoro, D., Drennan, J., Kavanagh, D. J., Zhao, E. J., White, A. M., Previte, J., . . . Fry, M.-L. (2015). Designing a Mobile Social Tool that Moderates Drinking. *Pervasive Computing, IEEE*, 14(3), 62-69.
- Walitzer, K. S., & Connors, G. J. (1999). Treating problem drinking. *Alcohol Research & Health*, 23(2), 138-138.
- Walters, S. T., Miller, E., & Chiauuzzi, E. (2005). Wired for wellness: e-Interventions for addressing college drinking. *Journal of substance abuse treatment*, 29(2), 139-145.
- Weaver, E. R., Horyniak, D. R., Jenkinson, R., Dietze, P., & Lim, M. S. (2013). "Let's get Wasted!" and Other Apps: Characteristics, Acceptability, and Use of Alcohol-Related Smartphone Applications. *JMIR mHealth and uHealth*, 1(1), e9.
- Wechsler, H., Dowdall, G. W., Davenport, A., & Castillo, S. (1995). Correlates of college student binge drinking. *American journal of public health*, 85(7), 921-926.
- Zhao, G., Liu, G., Li, H., & Pietikäinen, M. (2006). *3D gait recognition using multiple cameras*. Paper presented at the Automatic Face and Gesture Recognition, 2006. FGR 2006. 7th International Conference on.

Appendix 1: Focus Group Data

Focus Group 1

Subject 1:

- iDrinkSmarter
 - Wouldn't take out phone
 - Inaccurate
- SoberApp
 - No Opinion
- BarTabKeepr
 - No Opinion
- SmartWatch
 - No Opinion
- MSB
 - No Opinion
- Gait
 - No Opinion
- Location
 - No Opinion
- Fingerprint
 - Doesn't prevent binge drinking
- Soberlink
 - No opinion
- AlcoChange
 - No Opinion

Subject 2:

- iDrinkSmarter
 - No Opinion
- SoberApp
 - What about drinks without barcodes?
- BarTabKeepr
 - No Opinion
- SmartWatch
 - No Opinion
- MSB
 - No Opinion
- Gait
 - Not walking around alot while drinking
 - Usefully after your drunk
- Location
 - No Opinion
- Fingerprint
 - No Opinion
- Soberlink

- No Opinion
- AlcoChange
 - No Opinion

Subject 3:

- iDrinkSmarter
 - The notifications could be useful.
- SoberApp
 - Share button to close to find taxi
 - Likes find a pub option
- BarTab Keepr
 - May be easier if it links to your credit card to track drinks
- U of T smartwatch app
 - Smartwatches bad at measuring heart rate and blood pressure
- MSB
 - What if someone doesn't want to keep track of drinking?
- Gait
 - Love anything on phone using accelerometers
 - Integrate into drink keeping apps
- Location
 - No Opinion
- Fingerprint
 - No opinion
- Soberlink
 - Photo ID is overkill
- AlcoChange
 - No Opinion

Subject 4:

- iDrinkSmarter
 - I Drink Smarter may require a user who is responsible about their drinking habits
 - Accurate
 - App could help you pay attention to how much you have been drinking.
- SoberApp
 - Sharing to facebook - major issues for future employment.
 - Share could also be detrimental to personal life
 - If someone says 'I don't think you should drive', can't argue with the app
 - Producing something without a barcode would be a minor issue for consideration
- BarTab Keepr
 - I don't think it allows apps that are open source to use credit cards/
 - Wake-up call if you're blowing your money
 - Should be password protected if someone finds how much you spend
 - Better as financial than keeping track of drinking
 - Add in parallel with other applications
- U of T smartwatch app

- More reasonable to be using smartwatch around friends to not be ridiculed
- Easier to use than other things
- Smartwatch stuff takes considerable measures for information privacy
- Smartwatch market is very small. May be less inclined to have unhealthy drinking habits
- \$20 to \$30 for similar tech used in the military. Not very durable.
- Going over \$50 would be a deterrent.
- One time cost of making app vs recurring cost of making watch
- Wearing watch could associate them with being a problem drinker
- Free app for cpr. Kept it on phone for 2 years, could drum up support if the app is free due to users talking about it to others.
- My Student Body
 - Reminds me of alcohol edu like WPI. Could become a hassle for people to use.
 - Not as convenient as a phone app.
 - People want to avoid their problems.
 - Target audience focused towards people who just became 21, learn alcohol information/safety facts.
- Gait
 - Read up about this product for measuring strokes or concussions. Technology is still new and may not be reliable?
 - May be one of the best measures for detecting a slew of things, but may not be available in the near future.
 - People who get drunker may move around and trigger alarm before driving or other dangerous activities.
- Location
 - Mainly see use for this by alcoholics
 - Otherwise it would be an unwanted reminder.
- Fingerprint
 - If it is accurate, might be nice.
 - Discrete way of checking alcohol BAC levels.
 - Not a good idea to put on every vehicle. Demonizes alcohol and is intrusive
- Soberlink
 - Accesses your contacts
 - More for use with people who have a huge problem.
 - Not a good idea for our age group.
- AlcoChange
 - Cool way of checking up on yourself.
 - Glaring issues concerning social stigmas

Subject 5:

- iDrinkSmarter
 - Manually input drinks?
 - Concerned about interface
 - Doubts they are used frequently
 - A lot of work
 - More proactive app

- SoberApp
 - No opinion
- BarTab Keepr
 - Really likes this concept, being financially tied is good
 - People focused on money rather than drinking
- U of T smartwatch app
 - Could be of in nightclub like environments. Good if it works well
 - Buying app just to measure drinking could be socially awkward
- My Student Body
 - Was thinking it would be like a once a month check in sort of thing.
 - Couldn't see people using it other then that
- Gait
 - No opinion
- Location
 - No opinion
- Fingerprint
 - Really neat, could be in a police officer's car
- Soberlink (Left at this point)
 -

Subject 6 (entered late):

- U of T smartwatch app
 - Device sole purpose was to do just this: \$50 limit
 - Just an app: not much
 - Everything goes up from the one time dev cost
 - Can't tell what someone is doing on their smartwatch
 - If the app was cheap/free could release dlc?
- My Student Body
 - Great if the user wants to keep track and knows they have a problem
 - What's to stop someone else from manipulating the data they put in
 - A lot harder to fool something biological
- Gait
 - There will be a number of people who don't walk drunk or could be mistaken for drunk walking.
 - Inaccurate tech
 - How would the app interact with the user?
- Location
 - Why the satellites inform you if you are heading towards a place with alcohol (you would probably know already)
 - May cause user to drink more if they weren't thinking about alcohol
 - Implementation cost?
- Fingerprint
 - Considering savviness of cars, would not be unreasonable to implement.
 - Great way to monitor drinking
- Soberlink

- No opinion
- AlcoChange
 - Neat way of implementing breathalyzer

Focus Group 2

Subject 1:

- iDrinkSmarter
 - If it started a session and you put in stuff as you continue drinking, it would be better.
 - Just a button to input drinks.
 - Valuable to keep track of time/how long you have been drinking.
- SoberApp
 - I like how it shows how much time till you can drive
 - If the app does more for me, i feel like I would be
 - Bartender wouldn't bother with barcodes
 - Would people want to use this?
- BarTabKeepr
 - My only issue is that it gears towards older people
 - Geared towards someone in a bar
 - Worried about younger people who might be drinking in someone's house
 - As a wpi project, most people are not of age, and would not be worthwhile
- SmartWatch
 - Fact that it is automatic is great.
 - Caters towards wealthy people
 - Like it to be on something you already own. Maybe an attachment
 - Maybe if it weren't a completely separate device
- MSB
 - Probably wouldn't use because of personality
 - Get bored of it after a while
 - If it were an app that encouraged you to report everyday, might use it more.
- Gait
 - Would be bad if you have to hold it.
 - Possibly have some sort of motor control test on the app
- Location
 - Good if you don't want to drink at all anymore.
 - Not good if you just drink casually
- Fingerprint
 - Never driven drunk but has been drunk so wouldn't use the device
 - Would use uber or something before driving drunk
 - Doesn't involve using blood
 - Advantage over breathalyzer?
 - If you had a problem and have to have this, it's an incentive to not getting drunk
- Soberlink
 - How is this used by law enforcement?
 - Text someone when you require help

- AlcoChange
 - I like the idea of the attachment a lot, but that would be a thing I would lose/break
 - Like drink tracking thing
 - Used in a predatory way? Mess with it when you're not paying attention

What is the target group for the devices we're presenting?

Subject 2:

- iDrinkSmarter
 - Could be useful if trying to help a friend.
 - Is a lot of trouble remembering to put it in.
 - Might be tough to put it in yourself, might do it for someone else.
 - If it keeps a running count it is better. (disregard previous notes)
 - Already has gender and weight, and start session would be good.
 -
- SoberApp
 - Share it.
 - Barcode scanning is a cool thing.
 - Maybe use a combination where you can use it to call a taxi.
 - Button with scanning
 - Get around it with average bac
 - Different buttons for different drink sizes, good estimate for drinks.
 - If list of drinks is too excessive, it would be too annoying.
- BarTabKeepr
 - Specialized towards going out
 - Every bar may have a different price
 - More likely to buy and drink at home, and may not use the app
 -
- SmartWatch
 - If a fitbit had this, would probably buy it
 -
- MSB
 - Would work as a thing if you knew you had a problem
 - Like risk assessment for sorority
 - If you're a binge drinker it would make you feel shitty, and you would stop.
 -
- Gait
 - How is it used? Have it in the pocket or holding it.
 - If I'm walking around and i'm drunk I would know it. Would make faking it out a game.
 - Would not work well at discouraging binge drinking.
 - Drink wine sitting down a lot.
 - If you sit and drink a lot doesn't work well.
- Location
 - Just increases the amount of drinking in a place you were going to?
 - Could cause worse things for people with a problem.

- Fingerprint
 - I don't drive drunk so I probably wouldn't
 - Probably use something like a fitbit
 - Subtle until you can't drive
 - Interesting if it weren't associated with a car, might even use when sober
- Soberlink
 - Like an AA perk thing
- AlcoChange
 - Leave my phone places during a party, would be difficult to keep track.

Subject 3:

- iDrinkSmarter
 - Liked it if it would be non active, ie it did it for you
- SoberApp
 - May not measure the actual amount of components in drink, so may not be accurate.
- BarTabKeepr
 - Thinks this may work for age range
 - Doesn't shame person for over drinking
- SmartWatch
 - Would not buy standalone device
 - Add on to fit bit
- MSB
 - Might not use them or continue to use them
 - Good tool for those who want to stop drinking
- Gait
 - Questioned accuracy of device
 - Not only walking when drunk
 - Who does in know your walking?
- Location
 - You can get drunk anywhere
- Fingerprint
 - Invasive
 - Might require too much of a voluntary user
- Soberlink
 - Likes the contact idea for contacting people who can help
 - Don't want to bother
- AlcoChange
 - Agrees with losing an attachment

Subject 4:

- iDrinkSmarter

- Would be annoying if you had to recalculate after each drink or had to remember the number you had
- SoberApp
 - Can't picture having a bartender give you the barcode in a crowded setting
 - Should be fairly simple
- BarTabKeepr
 - Useful in a bar but agrees with other participants concerns.
- SmartWatch
 - Simple
 - People like gadgets
- MSB
 - Anonymous?
 - Would be useful if the person wants to try and identify if they have a problem
- Gait
 - Does it need to be active all the time?
 - Doesn't hurt, but might not help.
- Location
 - Agree with other participants
- Fingerprint
 - Good safety feature
- Soberlink
 - Questioning target demographic for devices
- AlcoChange
 - Worried about leaving device around

Appendix 2: Survey Data

Initial Report

Last Modified: 04/24/2016

1. What year are you currently enrolled in?

#	Answer		Response	%
1	Freshmen		0	0%
2	Sophomore		0	0%
3	Junior		2	40%
4	Senior		2	40%
5	Graduate		1	20%
6	Other		0	0%
	Total		5	100%

2. What gender do you identify as?

#	Answer	Response	%
1	Male	2	40%
2	Female	2	40%
3	Other	1	20%
	Total	5	100%

Statistic	Value
Min Value	1
Max Value	3
Mean	1.80
Variance	0.70
Standard Deviation	0.84
Total Responses	5

3. When was the last time you consumed alcohol?

#	Answer	Response	%
1	0-1 Weeks	5	100%
2	2-3 Weeks	0	0%
3	1+ Months	0	0%
4	Never	0	0%
	Total	5	100%



4. How frequently do you consume 5+ alcoholic beverages in one occasion?

#	Answer	Response	%
1	Weekly or less	1	20%
2	Every 2-3 Weeks	0	0%
3	Monthly	0	0%
4	Never	4	80%
	Total	5	100%



5. Please indicate the frequency with which you use a smartphone

#	Answer	Response	%
1	Daily	4	80%
2	Weekly	0	0%
3	Monthly or less	1	20%
4	Never	0	0%
	Total	5	100%



6. Please indicate the frequency with which you use email

#	Answer		Response	%
1	Daily		4	80%
2	Weekly		0	0%
3	Monthly or less		0	0%
4	Never		1	20%
	Total		5	100%

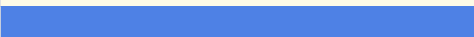
7. Please indicate the frequency with which you use a laptop or personal computer

#	Answer		Response	%
1	Daily		4	80%
2	Weekly		0	0%
3	Monthly or less		0	0%
4	Never		1	20%
	Total		5	100%



8. Please indicate the frequency with which you use a tablet

#	Answer		Response	%
1	Daily		0	0%
2	Weekly		2	40%
3	Monthly or less		0	0%
4	Never		3	60%
	Total		5	100%




9. Please indicate the frequency with which you use a smartwatch

#	Answer		Response	%
1	Daily		0	0%
2	Weekly		0	0%
3	Monthly or less		0	0%
4	Never		5	100%
	Total		5	100%


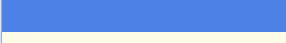

10. Please indicate the frequency with which you use a Fitbit

#	Answer		Response	%
1	Daily		1	20%
2	Weekly		0	0%
3	Monthly		0	0%
4	Never		4	80%
	Total		5	100%




11. I think this app would help promote safe drinking.

#	Answer		Response	%
1	Strongly Disagree		1	20%
2	Disagree		1	20%
3	Neutral		0	0%
4	Agree		3	60%
5	Strongly Agree		0	0%
	Total		5	100%




12. I would use this application in a drinking environment (at a party or bar).

#	Answer		Response	%
1	Strongly Disagree		1	20%
2	Disagree		3	60%
3	Neutral		0	0%
4	Agree		1	20%
5	Strongly Agree		0	0%
	Total		5	100%

13. I think it is important that this application determines BAC accurately.

#	Answer		Response	%
1	Strongly Disagree		1	20%
2	Disagree		0	0%
3	Neutral		0	0%
4	Agree		1	20%
5	Strongly Agree		3	60%
	Total		5	100%

14. I am concerned about how others would perceive me for using this app.

#	Answer		Response	%
1	Strongly Disagree		1	20%
2	Disagree		3	60%
3	Neutral		1	20%
4	Agree		0	0%
5	Strongly Agree		0	0%
	Total		5	100%

15. If you would like to elaborate on any of these responses please do so here:

Text Response

I am unsure that blood alcohol content can be measured correctly with only body weight and gender. More information is needed, such as body fat percentage, water percentage, etc. to accurately determine the blood alcohol level. Therefore, this would not appeal to many people because it is a guesstimate.

These already exist and this is a worthless project.

If it isn't accurate someone might think they are less drunk than they are and decide they are ok to drive based on incorrect info

Statistic	Value
Total Responses	3



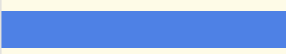
16. I think this app would help promote safe drinking.

#	Answer	Response	%
1	Strongly Disagree	1	20%
2	Disagree	0	0%
3	Neutral	1	20%
4	Agree	3	60%
5	Strongly Agree	0	0%
	Total	5	100%





17. I would use this application in a drinking environment (at a party or bar).

#	Answer	Response	%
1	Strongly Disagree	1	20%
2	Disagree	4	80%
3	Neutral	0	0%
4	Agree	0	0%
5	Strongly Agree	0	0%
	Total	5	100%

18. I think it is important that this application determines BAC accurately.

#	Answer		Response	%
1	Strongly Disagree		1	20%
2	Disagree		0	0%
3	Neutral		0	0%
4	Agree		1	20%
5	Strongly Agree		3	60%
	Total		5	100%

19. I am concerned about how others would perceive me for using this app.

#	Answer		Response	%
1	Strongly Disagree		1	20%
2	Disagree		1	20%
3	Neutral		2	40%
4	Agree		1	20%
5	Strongly Agree		0	0%
	Total		5	100%

20. If you would like to elaborate on any of these responses please do so here:

Text Response

I would hate for someone to use this thinking that they are safe to drive and then get into an accident because they had too much trust. I think it is a good idea in theory, but it is also a lot of work that would detract from the "fun" time at a party or bar.





It is kind of hard and awkward to ask for the original container that the alcohol was in to scan the bar code when you are at a bar. If you're at a party, asking for the bar code is sometimes outright impossible or even more awkward.

This also already exists and wouldn't be feasible in most drinking situations.


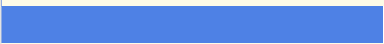
same comment about accuracy

Statistic	Value
Total Responses	4

21. I would use this application in a drinking environment (at a party or bar).


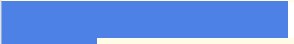

#	Answer		Response	%
1	Strongly Diagree		1	20%
2	Disagree		1	20%
3	Neutral		2	40%
4	Agree		0	0%
5	Strongly Agree		1	20%
	Total		5	100%

22. I think this app would help promote safe drinking.

#	Answer		Response	%
1	Strongly Diagree		1	20%
2	Disagree		0	0%
3	Neutral		0	0%
4	Agree		4	80%
5	Strongly Agree		0	0%
	Total		5	100%

Statistic	Value
Min Value	1
Max Value	4
Mean	3.40
Variance	1.80
Standard Deviation	1.34
Total Responses	5

23. I am concerned about how others would perceive me for using this app.

#	Answer		Response	%
1	Strongly Diagree		1	20%
2	Disagree		3	60%
3	Neutral		1	20%
4	Agree		0	0%
5	Strongly Agree		0	0%
	Total		5	100%

24. If you would like to elaborate on any of these responses please do so here:

Text Response

This is a lot of work that I feel I would quickly get tired of doing because of how drunk I feel
It's easy to overspend at bars

Statistic	Value
Total Responses	2

25. I think this app would help promote safe drinking.

#	Answer	Response	%
1	Strongly Disagree	1	20%
2	Disagree	0	0%
3	Neutral	1	20%
4	Agree	3	60%
5	Strongly Agree	0	0%
	Total	5	100%



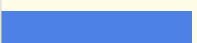
26. I would use this application in a drinking environment (at a party or bar).

#	Answer	Response	%
1	Strongly Disagree	1	20%
2	Disagree	0	0%
3	Neutral	1	20%
4	Agree	1	20%
5	Strongly Agree	2	40%
	Total	5	100%




27. I think it is important that this application determines BAC accurately.

#	Answer	Response	%
1	Strongly Disagree	1	20%
2	Disagree	0	0%
3	Neutral	0	0%
4	Agree	0	0%
5	Strongly Agree	4	80%
	Total	5	100%




28. The cost of this technology is an important factor in whether or not I use it.

#	Answer		Response	%
1	Strongly Disagree		1	20%
2	Disagree		0	0%
3	Neutral		0	0%
4	Agree		2	40%
5	Strongly Agree		2	40%
	Total		5	100%



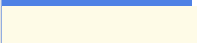
29. I am concerned about how others would perceive me for using this technology

#	Answer		Response	%
1	Strongly Disagree		1	25%
2	Disagree		1	25%
3	Neutral		2	50%
4	Agree		0	0%
5	Strongly Agree		0	0%
	Total		4	100%


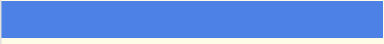
30. I think this app would help promote safe drinking.

#	Answer		Response	%
1	Strongly Disagree		1	20%
2	Disagree		1	20%
3	Neutral		1	20%
4	Agree		2	40%
5	Strongly Agree		0	0%
	Total		5	100%




31. I would use this application in a drinking environment (at a party or bar).

#	Answer		Response	%
1	Strongly Disagree		1	20%
2	Disagree		2	40%
3	Neutral		0	0%
4	Agree		2	40%
5	Strongly Agree		0	0%
	Total		5	100%

32. I think it is important that this application determines BAC accurately.

#	Answer		Response	%
1	Strongly Disagree		1	20%
2	Disagree		0	0%
3	Neutral		0	0%
4	Agree		0	0%
5	Strongly Agree		4	80%
	Total		5	100%

33. I am likely to walk around while I am drinking.

#	Answer		Response	%
1	Strongly Disagree		0	0%
2	Disagree		2	40%
3	Neutral		2	40%
4	Agree		1	20%
5	Strongly Agree		0	0%
	Total		5	100%

34. If you would like to elaborate on any of these responses please do so here:



Text Response

I am not sure how this could accurately tell blood alcohol content, but it seems like an interesting idea. I like that it requires less manual data input.

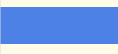
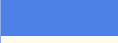
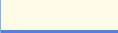

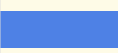
I don't think this app would be too useful because there may be other factors that contribute to messing up the data gathered from someone's walking pattern.

Statistic	Value
Total Responses	2


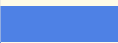

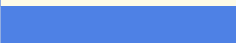
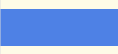
35. I think this app would help promote safe drinking.

#	Answer		Response	%
1	Strongly Disagree		0	0%
2	Disagree		3	75%
3	Neutral		1	25%
4	Agree		0	0%
5	Strongly Agree		0	0%
	Total		4	100%

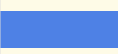




36. I would use this device.

#	Answer		Response	%
1	Strongly Disagree		1	25%
2	Disagree		1	25%
3	Neutral		0	0%
4	Agree		1	25%
5	Strongly Agree		1	25%
	Total		4	100%

37. This would only remind me to drink.

#	Answer		Response	%
1	Strongly Disagree		0	0%
2	Disagree		1	25%
3	Neutral		0	0%
4	Agree		2	50%
5	Strongly Agree		1	25%
	Total		4	100%

38. I am concerned about how others would perceive me for using this app.

#	Answer		Response	%
1	Strongly Disagree		1	25%
2	Disagree		1	25%
3	Neutral		2	50%
4	Agree		0	0%
5	Strongly Agree		0	0%
	Total		4	100%

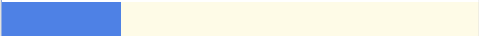

39. If you would like to elaborate on any of these responses please do so here:

Text Response



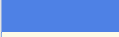
I am not sure how this would really be helpful in limiting my alcohol consumption
Tell me when this one's available

Statistic	Value
Total Responses	2


40. I think this app would help promote safe drinking.

#	Answer		Response	%
1	Strongly Disagree		0	0%
2	Disagree		0	0%
3	Neutral		1	25%
4	Agree		3	75%
5	Strongly Agree		0	0%
	Total		4	100%

41. I would use this application in a drinking environment (at a party or bar).

#	Answer		Response	%
1	Strongly Disagree		1	25%
2	Disagree		2	50%
3	Neutral		0	0%
4	Agree		1	25%
5	Strongly Agree		0	0%
	Total		4	100%

42. I am concerned about how others would perceive me for using this app.



#	Answer		Response	%
1	Strongly Disagree		0	0%
2	Disagree		4	100%
3	Neutral		0	0%
4	Agree		0	0%
5	Strongly Agree		0	0%
	Total		4	100%

43. If you would like to elaborate on any of these responses please do so here:


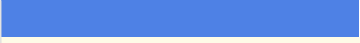
Text Response

Statistic	Value
Total Responses	0


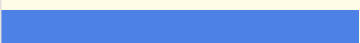
44. I think this app would help promote safe drinking.

#	Answer		Response	%
1	Strongly Disagree		0	0%
2	Disagree		0	0%
3	Neutral		0	0%
4	Agree		2	50%
5	Strongly Agree		2	50%
	Total		4	100%



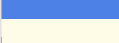
45. I would use this application in a drinking environment (at a party or bar).

#	Answer		Response	%
1	Strongly Disagree		0	0%
2	Disagree		0	0%
3	Neutral		1	25%
4	Agree		3	75%
5	Strongly Agree		0	0%
	Total		4	100%

46. I think it is important that this application determines BAC accurately.

#	Answer		Response	%
1	Strongly Disagree		0	0%
2	Disagree		0	0%
3	Neutral		0	0%
4	Agree		1	25%
5	Strongly Agree		3	75%
	Total		4	100%

47. I am concerned about how others would perceive me for using this app.

#	Answer		Response	%
1	Strongly Disagree		0	0%
2	Disagree		2	50%
3	Neutral		1	25%
4	Agree		1	25%
5	Strongly Agree		0	0%
	Total		4	100%

48. If you would like to elaborate on any of these responses please do so here:

Text Response

I think this would be easy to carry in a purse and use when in the bathroom to make sure you do not have more than you can handle [alcohol]
seems like something a drunk person might lose

Statistic	Value
Total Responses	2

49. I think this app would help promote safe drinking.

#	Answer	Response	%
1	Strongly Disagree	0	0%
2	Disagree	0	0%
3	Neutral	0	0%
4	Agree	3	75%
5	Strongly Agree	1	25%
	Total	4	100%

50. I think this technology would interfere with driving an automobile while sober.

#	Answer	Response	%
1	Strongly Disagree	0	0%
2	Disagree	1	25%
3	Neutral	0	0%
4	Agree	3	75%
5	Strongly Agree	0	0%
	Total	4	100%

51. I am concerned about how others would perceive me for using this app.

#	Answer	Response	%
1	Strongly Disagree	0	0%
2	Disagree	3	75%
3	Neutral	1	25%
4	Agree	0	0%
5	Strongly Agree	0	0%
	Total	4	100%

52. If you would like to elaborate on any of these responses please do so here:

Text Response

I worry that a drunk person might convince a friend to breathe into this
It might get a little annoying if you have to use the breathalyzer every single time you want to drive your car.

Statistic	Value
Total Responses	2

53. Age

Text Response

22
21
20
21
21
21

Statistic	Value
Total Responses	6