

Reduction of College Drinking with SobriVu Smart Glasses Utilizing Motivational Interviewing and Social Normalization of Sobriety

Arushi Uppal, email: uppal.aru@northeastern.edu

Carey Barry, email: c.barry@northeastern.edu

Presanth Adhini Ramesh, email: adhiniramesh.p@northeastern.edu

ABSTRACT

SobriVu smart glasses are a proposed solution to address problematic drinking among college students. SobriVu leverages theory-based interventions targeting user attitudes toward drinking and perceptions of social norms about drinking to motivate behavioral intention and behavior change. SobriVu tracks alcohol intake and delivers interactive motivational interviewing through text-based messages in the visual field with tailored interactions and user feedback to support self-motivated behavioral intentions to reduce drinking. Visual exposure to social media images normalizing sobriety is delivered to alter perceptions of social norms. SobriVu smart glasses will be evaluated with a randomized controlled trial comparing SobriVu to a control group. Measures of problematic drinking (AUDIT-C questions, days of binge drinking, drinks/day, and alcohol-related injury) will be compared at baseline, three months, six months, and nine months after use. Beyond innovative technology, SobriVu blends with users' daily lives to serve as a useful health tool and fashionable accessory.

MOTIVATION

Alcohol consumption among college students remains high, with 71% of undergraduate students reporting alcohol use in their lifetime. [1] The United States (US) 2022 National Survey on Drug Use and Health revealed that in the past month, approximately half of college students had consumed alcohol, 26.8% of male and 29.3% of female college students had engaged in binge drinking, and 9.3% of male and 6.2% of female college students reported heavy alcohol use. [2] Furthermore, pervasive positive attitudes toward drinking among college students have been portrayed through social media [3] and have been identified as a predictor of alcohol use and problematic outcomes. [4]

Problematic drinking has been defined as the consumption of alcohol resulting in unintended problems without physical dependence. [5–7] Problematic drinking can lead to unintended consequences. [8,9] In studies using national data sets, it was estimated that annual outcomes among college students related to alcohol use include over 1,800 deaths, nearly 600,000 injuries, over 600,000 physical assaults, and almost 100,000 sexual assaults. [8,10] Additional adverse outcomes that have been associated with alcohol use include suicide attempts, health complications, memory loss, academic difficulties, and alcohol dependence. [8,9] Problematic drinking among college students remains a challenging health issue in the US, and measures to address this issue are crucial.

RELATED WORK

College Drinking Habits and Motivations

Drinking habits and motivations for alcohol use by college students are central to the development of successful interventions. Tremblay et al. identified higher alcohol intake among college students on weekends and during events such as Halloween and New Year's. [11] Given the timing of alcohol consumption, the likely point of decision for partaking in alcohol use includes Thursdays and the days leading to social events. While various motives have been identified for college student drinking, social comradery was most frequently endorsed as a motive in a study by Labrie et al. 2007. [12] Furthermore, triggers of alcohol cravings have been noted in different settings such as parties, restaurants, and homes, and times such as nighttime and on weekends. [13] Leveraging knowledge of motives and the point of decision will be important considerations for intervention.

Alcohol Screening

The Alcohol Use Disorders Identification Test Consumption (AUDIT-C) is a validated screening tool to evaluate for problematic drinking. [6,14] The screening tool consists of three questions (table 1) and has been shown to have higher response rates than longer screening questionnaires. [6] The simplicity and validity of this tool are ideal.

Alcohol Use Disorders Identification Test Consumption (AUDIT-C)[6]	
1. How often did you have a drink containing alcohol in the past year? Consider a “drink” to be a can or bottle of beer, a glass of wine, a wine cooler, or one cocktail or a shot of hard liquor (like scotch, gin, or vodka).	Response options: <input type="radio"/> never (0 points) <input type="radio"/> monthly or less (1 point) <input type="radio"/> 2 to 4 times a month (2 points) <input type="radio"/> 2 to 3 times a week (3 points) <input type="radio"/> 4 to 5 times a week (4 points) <input type="radio"/> 6 or more times a week (4 points)
2. How many drinks did you have on a typical day you were drinking in the past year?	Response options: <input type="radio"/> 0 drinks (0 points) <input type="radio"/> 1 to 2 drinks (0 points) <input type="radio"/> 3 to 4 drinks (1 point) <input type="radio"/> 5 to 6 drinks (2 points) <input type="radio"/> 7 to 9 drinks (3 points) <input type="radio"/> 10 or more drinks (4 points)
3. How often did you have 6 or more drinks on one occasion in the past year?	Response options: <input type="radio"/> never (0 points) <input type="radio"/> less than monthly (1 point) <input type="radio"/> monthly (2 points) <input type="radio"/> weekly (3 points) <input type="radio"/> daily or almost daily (4 points)
AUDIT-C Score	Summed for a possible score of 0 to 12. ³ 3 in women and ⁴ 4 in men is positive.
Table 1. Alcohol Use Disorders Identification Test Consumption (AUDIT-C). The AUDIT-C questions are validated to screen for problematic drinking. The survey consists of three questions and the score is the sum of the individual scores for each of the questions. A sum score of ³ 3 in women and ⁴ 4 in men is a positive and the higher the number the more likely problematic drinking is impacting the individual.[6]	

Alcohol Use Interventions

Motivational interviewing (MI) is a counseling technique that has been successfully utilized in reducing alcohol use among college students. [15,16] MI techniques enhance motivation for behavior change by empowering autonomy and internal motivation rather than a paternalistic or authoritarian approach. [15,17,18] Common MI techniques include asking open-ended questions and mirroring answers in a reflection, affirmations, or summarizations of responses. [17,18] Other MI techniques include encouragement of change talk or expression of attitude toward change; example questions can be found in Table 2.[17,18]

Additionally, MI techniques have been successfully utilized in technological interventions, including text messaging, to reduce alcohol use. [19–21] In a study by Suffoletto et al., 2013, text messages reduced binge drinking among young adults, as reflected in participant pre-weekend drinking intentions and post-weekend consumption data. [21] Suffoletto et al., 2015, conducted a three-armed randomized controlled trial evaluating if text messaging interventions reduced binge drinking among a cohort (n=765) of 18–25-year-old participants. [22] Participants enrolled through emergency departments were randomized to one of three groups: 1) text messaging self-assessment with interactive, tailored feedback and alcohol monitoring, 2) text messaging self-assessment with alcohol monitoring, or 3) no texting intervention. Models for the intervention with feedback included MI and the Theory of Reasoned Action (TRA). [20,23]

Findings showed a statistically significant reduction in binge drinking, alcohol consumption, alcohol-related injury, and AUDIT-C scores. [22]

Change Talk	Questions to provoke change talk.
Disadvantages continuing current drinking behavior	<ul style="list-style-type: none"> • What worries you about your drinking habits? • What difficulties have resulted from your drinking?
Advantages of changing drinking habits	<ul style="list-style-type: none"> • How would you like your drinking habits to be in five years? • What are the advantages to reducing your drinking? • What would be different in your life if you reduced your drinking?
Optimism for changing drinking habits	<ul style="list-style-type: none"> • How have you made other changes in your life before? • What strengths do you have that would help you make a change?
Intention to change drinking habits	<ul style="list-style-type: none"> • In what ways do you want your life to be different in five years? • What ways do you want to change?

Table 2. Motivational Interviewing Techniques. Examples of questions that can be used to provoke change talk regarding reduction of alcohol intake. Table adapted from Hall, et al., 2020.[17]

Smart Glasses Technology

Utilizing wearable glasses with a mounted camera and onboard computer featuring custom-trained object recognition achieves a 90% accuracy rate in successfully capturing daily alcohol consumption. [24]

PROPOSED TECHNOLOGY

SobriVu smart glasses are a proposed solution to address problematic drinking among college students.

The Theory of Reasoned Action (TRA) positions that *attitudes* and *social norms* influence *behavioral intention*, which *predicts behavior*. [25–27] SobriVu leverages the Theory of Reasoned Action-based interventions targeting user attitudes toward drinking and perceptions of social norms about drinking to motivate behavioral intention and behavior change.

SobriVu smart glasses feature alcohol intake tracking and deliver interactive motivational interviewing through text-based messages in the visual field with tailored interactions and user feedback to support self-motivated behavioral intentions to reduce drinking. Visual exposure to social media images normalizing sobriety is delivered with the aim of altering perceptions of social norms.

SobriVu integrates MI techniques to deliver text-based content in the users' visual field, prompting user engagement in an MI session at planned times determined by the user on Thursdays, Sundays, and prior to any user-identified social events. Examples of interactive questions motivating change talk can be found in Table 2. The user responds to the questions by speaking, SobriVu glasses capture the responses through microphones, and the audio is translated to text with voice recognition software. These interactions are used to tailor messaging in reflections and in future messaging. These sessions will focus on attitudes, motivation for change, and eliciting used change talk. SobriVu carefully traverses the terrain of influencing attitudes toward change.

Concurrently, SobriVu engages with the sociocultural context by scrutinizing subjective norms and delving into the multifaceted influences of social networks and societal expectations. Furthermore, MI increases people's confidence in their capacity to influence positive behavioral changes. By converting the theoretical underpinnings of TRA into a useful methodology, MI is shown to be an effective behavioral intervention strategy while revealing the intricate dynamics of human motivation.

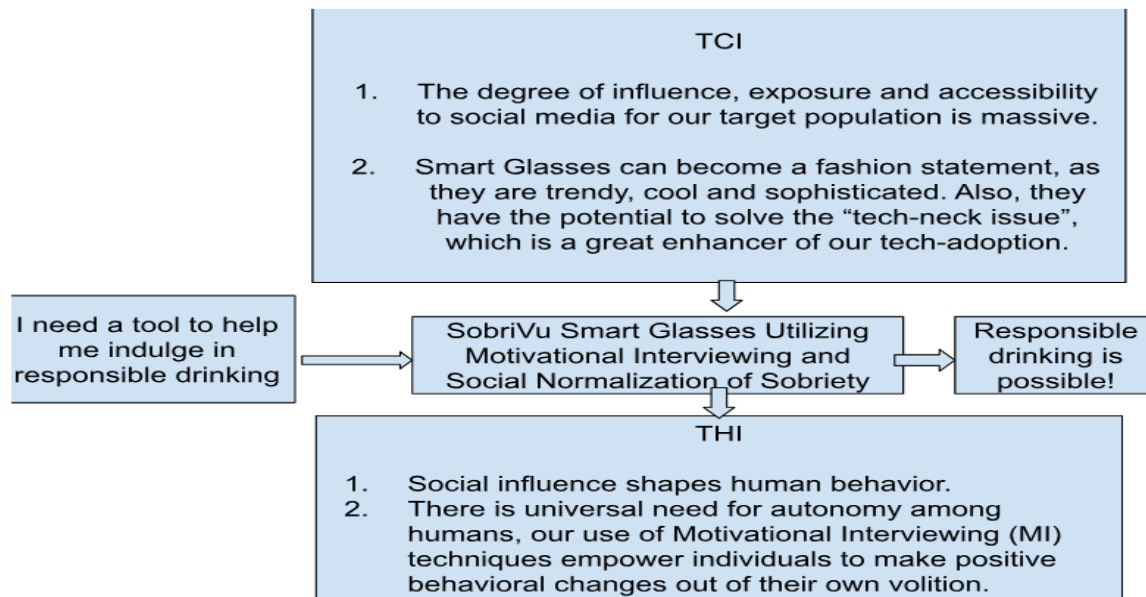


Fig 1: Slavin's model for the proposed solution

The innovative solution to address alcohol consumption draws on the Theory of Reasoned Action (TRA) based on social norms. The glasses intervene at the opportune moment, guided by the user's AUDIT-C survey responses and baseline drinking habits, ensuring the user deviates from the regular drinking routine—validated audit C questions aid in comprehending the behavior of users consuming alcohol. The recurring intervention strategies implemented every three months, in conjunction with the smart glasses and their integration with social media, collectively play a pivotal role in shaping and influencing societal norms surrounding alcohol consumption.

Content interventions through glasses can significantly contribute to behavioral change, considering the influential role of social norms in an individual's actions. Displaying content that normalizes alternatives, such as mocktails instead of cocktails or engaging in activities like hiking or indoor gaming instead of the common practice of socializing in bars/pubs, can encourage users to adopt healthier choices. This approach aims to promote positive changes in behavior by normalizing activities aligned with user's preferences.

Potential triggers for the user include observing places with signs of alcohol consumption, such as people drinking, pubs or bars along roads, as well as encountering content or hearing discussions related to alcohol. When individuals experience stress or sadness, they often turn to drinking, which can also be considered a trigger point. Our glasses can leverage the capability to recognize trigger words like "stress" and "sad" to act accordingly, providing timely interventions. This approach avoids reinforcing a social norm that associates sadness with drinking. We aim to induce behavioral change through our smart glass, utilizing its motivational intervention features. These situations have the potential to prompt the user to think about alcohol and may contribute to their decision to consume it. [13]

SobriVu can identify potential alcohol triggers in the user's surroundings, previously highlighted by the user, activating the system to tailor MI questions accordingly. Additionally, the comprehensive tracking cycle ensures continuous monitoring of the student's concerns and vulnerabilities that may lead to alcohol consumption. By implementing targeted interventions and content adjustments focused on reshaping social norms, SobriVu aims to significantly improve the user's response to triggers and promote healthier behavioral choices.

TECHNOLOGY DESIGN

SobriVu smart glasses, featuring a camera, microphone, and speaker, monitor students' alcohol intake. This, coupled with the cyclical implementation of motivational interventions through surveys, allows for personalized content delivery tailored to the user's interests, facilitating progress tracking throughout quarterly surveys. Complemented by content streaming, this design promotes self-awareness regarding behavioral changes over time. This iterative approach provides a dynamic visual representation of the user's journey, elevating awareness and motivation to instigate positive behavioral changes.

EVALUATION PLAN

SobriVu smart glasses will be evaluated in a randomized controlled trial to determine whether undergraduate college students who receive interventions delivered through SobriVu smart glasses reduce problematic drinking.

SobriVu smart glasses with MI and Social Media Exposure x 9 months

C: Smart glasses without programmed intervention x 9 months

Participants

Innovative interventions are required due to the substantial prevalence of problematic drinking among college students. SobriVu smart glasses present a potential strategy by integrating social norms and readily accessible technology. The RCT design guarantees a thorough evaluation of the spectacles' effectiveness.

Participants will be recruited using various strategies, including working with university health services, utilizing social media (Facebook, Instagram), and holding informational workshops on campus. A dedicated website with comprehensive study information will facilitate online recruiting. This methodology guarantees heterogeneous participant demographics and optimizes outreach to prospective persons who might not be accessible via a solitary technique. Establishing partnerships with university health services can improve credibility and institutional support.

In recognition of their time and participation in the study, participants will receive gift cards for Starbucks or an on-campus food outlet. This will encourage study protocol compliance and ensure participant retention.

Inclusion Criteria:

- UG College Students - Women with an AUDIT-C score ³3 or men with an AUDIT-C score ³4.
- Undergraduate students aged 18-25 years.
- Expressed desire to reduce drinking.
- Fluent in English.

Exclusion Criteria:

- Current treatment for psychiatric condition.
- Prior treatment for drug or alcohol use disorder.
- History of severe vision impairment or blindness.

The timeline of the study is as follows:

Month 1-2: Intensive participant recruitment, informed consent, and baseline assessments.

Month 3-6: Implementation of SobriVu smart glasses interventions, data collection at regular intervals, and continuous monitoring.

Month 7-8: Comprehensive data analysis, findings synthesis, and preparation for dissemination.

Month 9: Last follow-up evaluation and generating summary report for all participants.

Measures

Demographic data will be collected, including age, sex, gender identity, race, ethnicity, and educational year. This data will be utilized to tailor messages and ensure diversity in the cohort's representation. Participant sex is necessary to interpret the AUDIT-C screen [6] (table 1) and to determine binge drinking.

A survey question will collect information on the baseline daily use of glasses and sunglasses. Depending on this baseline use, the adoption of SobriVu smart glasses may vary.

Binge drinking has been defined as 4 or more continuous drinks in females and 5 or more continuous drinks for males. [14] To assess baseline binge drinking, candidates will be asked:

- Female: How many days in the last month have you had four (4) or more continuous drinks?
- Male: How many days in the last month have you had five (5) or more continuous drinks?

Measures for alcohol use and problematic drinking will include the AUDIT-C questions, self-reported alcohol-related injury, average drink per day, and days of binge drinking per month. These measures are reflective of the metrics that have been used in the literature as measures for alcohol use and problematic drinking. [21,22] The data collection plan and timeline are outlined in Table 3. Data will be collected every three months for nine months to demonstrate effectiveness over time.

The primary outcome of the study is a decrease in the AUDIT-C score, with secondary outcomes of a decrease in binge drinking days, decreased alcohol-related injury, and reduced average drinks per day.

Data Collection Plan and Timeline			
Baseline	3-months	6-months	9-months
Demographic Data	not collected	not collected	not collected
Use of Glasses			
Use of Sunglasses			
AUDIT-C	AUDIT-C	AUDIT-C	AUDIT-C
Alcohol-Related Injury ²	Alcohol-Related Injury	Alcohol-Related Injury	Alcohol-Related Injury
Average drink day ³	Average drink/day	Average drink/day	Average drink/day
Days binge drinking per month ⁴	Days binge drinking	Days binge drinking	Days binge drinking

Table 3. Data Collection Plan and Timeline. Participant data will be collected at baseline, three-months, six-months, and nine-months after beginning the intervention. The definitions and timelines are reflective of measures reflected in the literature.

1. AUDIT-C validated screening questions for problematic drinking (table 1).[6]
2. Alcohol related injury is self-reported injury over the past 3 months via survey question.
3. Average drink(s) per day will be self-reported daily average over the past 3 months via survey question at baseline and measured via SobriVu smart glasses prompt to log drinks and survey question at 3-months, 6-months, and 9-months.
4. Days binge drinking per month (4+/5+ female/male continuous drinks) will be self-reported via survey question at baseline and measured via SobriVu smart glasses and survey question at 3-months, 6-months, and 9-months.

Analysis

The data analysis pipeline for the SobriVu Smart Glasses Intervention Study involves a systematic approach to extracting meaningful insights from the collected data at various time points: baseline, 3-months, 6-months, and 9-months.

Descriptive Analysis

Summarizing demographic data using descriptive statistics, such as frequencies and percentages of alcohol use, gender distribution, age groups, etc., will provide an overall overview of participant characteristics.

Longitudinal Repeated Measures Analysis

ANOVA or linear mixed-effects models will be employed, with subgroup analyses conducted to explore potential differences. This approach aims to assess variations in AUDIT-C scores over time, providing insights into the effectiveness of the intervention.

Logistic Regression for Alcohol-Related Injuries

The study will utilize logistic regression models to evaluate the correlation between intervention exposure and the incidence of injuries linked to alcohol consumption. In this case, the outcome variable is whether an alcohol-related injury happened, which makes logistic regression a good fit as it is well suited for assessing binary outcome variables.

Analysis of Daily Average Drinks

Mixed-effect models are useful for studying longitudinal data with repeated measures. They are often referred to as hierarchical linear or multilevel models. They are adept at capturing the inherent variability and correlation found in repeated observations made by different people at different times. This is essential for assessing changes in daily average drinks when considering each participant's data contributions at baseline, three, six, and nine months. These models are more appropriate for this study because they consider both fixed effects (such as the influence of the intervention) and random effects (variations that are unique to each individual) in the trajectory.

Analysis of Binge-Drinking

Further, Generalized Estimation Equations (GEE) is a great option for analyzing changes in self-reported binge drinking frequency and SobriVu-measured binge drinking over a period of time since they can handle correlated and longitudinal data well. By accounting for the within-subject correlation, this method offers a reliable way to investigate the influence of the frequency of binge drinking in this long-term research. It is also well suited for repeated measurement of binary data.

Ethical Considerations and Privacy Protection

Finally, de-identification, data encryption, anonymization, secured data storage, custom data access controls, and informed consent will be deployed while presenting the results/insights based on the proposed experiment.

SCIENTIFIC SIGNIFICANCE

Glasses have evolved into a fashion statement [28], evolving from the primary purpose and making it more concentrated on the designs. Continuing to embrace fashionable glasses, contributing to the trend of eyewear as a fashion statement. Glasses has now been moving towards many technical add-ons where everyone is trying to fit in. [27] A stylish wearable model with display and recognition technology delivering motivation statements and effortlessly monitors alcohol consumption. SobriVu smart glasses will effortlessly become part of everyone's system as a fashion style prioritizing health and defining their fashion statement.[26] Being part of everyday life, this model of noninvasive monitoring and helping offers a practical solution in keeping mindful of alcohol consumption and, at the same time, providing them with assistance in promoting responsible drinking habits.

At the heart of SobriVu's efficacy lies its integration of Motivational Interviewing (MI) techniques and social media exposure. MI, a proven counseling technique, empowers individuals to internalize motivation for behavioral change[29]. By incorporating MI into a wearable technology context, SobriVu provides personalized, real-time interventions tailored to the user's responses from the Alcohol Use Disorders

Identification Test Consumption (AUDIT-C). This dynamic interaction identifies problematic drinking patterns and actively engages users in a journey towards healthier choices.

The proposed methodology leverages the ubiquitous nature of smart glasses to integrate interventions into users' daily lives seamlessly. SobriVu acts as a proactive companion, utilizing content interventions that challenge harmful social norms and provide tailored messages promoting sobriety. By identifying triggers such as stress or exposure to alcohol-related content, SobriVu ensures timely and targeted responses. This approach goes beyond mere identification; it fosters a supportive environment that actively encourages moderation and reshapes societal standards around alcohol consumption.

What sets SobriVu apart is its holistic understanding of the complexities surrounding college students' drinking habits. detect and address triggers and triggers but also employ social media exposure to normalize sobriety. Displaying healthy-drinking tailored posts encourages alternatives and positive activities, SobriVu seeks to redefine the narrative around drinking, promoting a sense of community and camaraderie centered on healthier choices.

In this age of digital domination, smart glasses provide an answer to the prevalent issue of "text neck.[30]" They support ergonomic practices and sustain sustained engagement with digital content by showing information at eye level. The proposed smart glass technology is an excellent motivation for people who want to reduce the stress that comes with using handheld devices for extended periods of time. This increases the adoption rate for the proposed solution.

In essence, SobriVu is not merely a technological gadget; it's a catalyst for cultural change. By seamlessly integrating into users' lives, offering proactive interventions, and challenging social norms, SobriVu has the potential to create a groundbreaking shift in the pervasive issue of problematic drinking among college students' successful, it is a comprehensive approach that could set new standards for preventative healthcare and community support in addressing alcohol-related concerns on college campuses.

SOCIETAL SIGNIFICANCE

With the integration of Smart Glasses, the proposed study seeks to lower problematic drinking among college students, with noteworthy social ramifications. Research consistently reveals the prevalence of alcohol addiction among college students, underscoring the seriousness of this issue. As per the National Institute on Alcohol Abuse and Alcoholism (NIAAA) data, approximately 60% of college students in the age range of 18 to 22 consume alcohol, which may result in several unfavorable consequences such as subpar academic performance, mishaps, and hazardous sexual conduct [23].

Using SobriVu Smart Glasses for motivational interviewing raises ethical concerns about privacy, permission, and potential effects on people's autonomy. It is crucial to ensure that the participants fully understand the nature of the intervention and willingly acknowledge the sensitive nature of the issue and any potential ramifications for their own lives. Furthermore, to avoid inadvertently stigmatizing those who suffer from alcohol-related issues, great caution must be exercised while using social media pictures to normalize well-being and sobriety [24].

It is necessary to fully acknowledge the risks and limitations of the proposed randomized controlled trial (RCT). The study's internal validity may be impacted by potential confounding variables, such as outside influences on participants' drinking habits. One of the most critical aspects of the intervention is participant adherence. Hence, techniques to improve compliance should be considered (Moore et al., 2011). Furthermore, the utilization of self-reported drinking behaviors raises the potential for social desirability bias, whereby individuals may deliberately underreport their alcohol usage to conform to societal norms [25]. Although the three-month period of the intervention may offer valuable insights into short-term impacts, it is unclear if the observed decreases in problematic drinking will last over the long term. Even though the treatments' goals are wellness and sobriety, there's a chance they could negatively impact certain students' mental health since they might feel stigmatized or scrutinized because of their drinking habits.

Additionally, issues with sample size and the possibility of selection bias threaten the generalizability of the research findings in the Randomized Controlled Trial evaluation [31]. Another limitation revolves around the potential rebel effect introduced by technology tracking users' intrinsic awareness of alcohol intake. Users might consciously or unconsciously rebel against the technology, altering their drinking behavior in response [32–34].

SobriVu has the potential to result in notable decreases in alcohol-related damage, better academic achievement, and increased well-being among college students. Additionally, the effect could ripple to impact social norms surrounding drinking and sobriety as well as public health. Beyond innovative technology, SobriVu transforms the relationship between wearables and health interventions by blending in with users' daily lives to serve as a useful health tool and fashionable accessories.

REFERENCES

- [1] Association ACH. National college health assessment-undergraduate student reference group data report spring 2022 2022.
- [2] Results from the 2022 National Survey on Drug Use and Health: detailed tables, SAMHSA, CBHSQ. section 8 pe tables. 2022.
[https://www.samhsa.gov/data/sites/default/files/reports/rpt42728/NSDUHDetailedTabs2022/NSDUHDetTabsSect8pe2022.htm](https://www.samhsa.gov/data/sites/default/files/reports/rpt42728/NSDUHDetailedTabs2022/NSDUHDetailedTabs2022/NSDUHDetTabsSect8pe2022.htm) (accessed January 31, 2024).
- [3] Cirillo MN, Halbert JP, Smith JG, Alamiri NS, Ingersoll KS. #BingeDrinking—Using social media to understand college binge drinking: qualitative study. *JMIR Human Factors* 2022;9:e36239.
<https://doi.org/10.2196/36239>.
- [4] DiBello AM, Miller MB, Carey KB. Positive heavy drinking attitude mediates the association between college alcohol beliefs and alcohol-related outcomes. *Addictive Behaviors* 2019;88:29–35. <https://doi.org/10.1016/j.addbeh.2018.08.005>.
- [5] Sobell MB, Sobell LC. Problem drinkers: Guided self-change treatment. New York, NY, US: The Guilford Press; 1996.
- [6] Bush K, Kivlahan DR, McDonell MB, Fihn SD, Bradley KA, for the Ambulatory Care Quality Improvement Project (ACQUIP). The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. *Archives of Internal Medicine* 1998;158:1789–95. <https://doi.org/10.1001/archinte.158.16.1789>.
- [7] Bien TH, Miller WR, Tonigan JS. Brief interventions for alcohol problems: a review. *Addiction* 1993;88:315–36. <https://doi.org/10.1111/j.1360-0443.1993.tb00820.x>.
- [8] White A, Hingson R. The burden of alcohol use. *Alcohol Res* 2014;35:201–18.
- [9] Wechsler H, Lee JE, Kuo M, Seibring M, Nelson TF, Lee H. Trends in college binge drinking during a period of increased prevention efforts: findings from 4 Harvard School of Public Health college alcohol study surveys: 1993–2001. *Journal of American College Health* 2002;50:203–17.
<https://doi.org/10.1080/07448480209595713>.
- [10] Hingson RW, Zha W. Age of drinking onset, alcohol use disorders, frequent heavy drinking, and unintentionally injuring oneself and others after drinking. *Pediatrics* 2009;123:1477–84.
<https://doi.org/10.1542/peds.2008-2176>.
- [11] Tremblay PF, Graham K, Wells S, Harris R, Pulford R, Roberts SE. When do first-year college students drink most during the academic year? An internet-based study of daily and weekly drinking. *Journal of American College Health* 2010;58:401–11.
<https://doi.org/10.1080/07448480903540465>.
- [12] Labrie JW, Hummer JF, Pedersen ER. Reasons for drinking in the college student context: the differential role and risk of the social motivator. *J Stud Alcohol Drugs* 2007;68:393–8.
- [13] Ghiță A, Teixidor L, Monras M, Ortega L, Mondon S, Gual A, et al. Identifying triggers of alcohol craving to develop effective virtual environments for cue exposure therapy. *Front Psychol* 2019;10:74. <https://doi.org/10.3389/fpsyg.2019.00074>.

- [14] Bradley KA, DeBenedetti AF, Volk RJ, Williams EC, Frank D, Kivlahan DR. AUDIT-C as a brief screen for alcohol misuse in primary care. *Alcoholism: Clinical and Experimental Research* 2007;31:1208–17. <https://doi.org/10.1111/j.1530-0277.2007.00403.x>.
- [15] Juarez P, Walters ST, Daugherty M, Radi C. A randomized trial of motivational interviewing and feedback with heavy drinking college students. *J Drug Educ* 2006;36:233–46. <https://doi.org/10.2190/753N-8242-727T-G63L>.
- [16] LaBrie JW, Thompson AD, Huchting K, Lac A, Buckley K. A group motivational interviewing intervention reduces drinking and alcohol-related negative consequences in adjudicated college women. *Addictive Behaviors* 2007;32:2549–62. <https://doi.org/10.1016/j.addbeh.2007.05.014>.
- [17] Hall K, Gibbie T, Lubman DI. Motivational interviewing techniques: facilitating behaviour change in the general practice setting. *Australian Family Physician* 2020;41:660–7. <https://doi.org/10.3316/informit.737035419857450>.
- [18] Miller WR, Rollnick S. *Motivational interviewing: Preparing people for change*, 2nd ed. New York, NY, US: The Guilford Press; 2002.
- [19] Fowler LA, Holt SL, Joshi D. Mobile technology-based interventions for adult users of alcohol: A systematic review of the literature. *Addictive Behaviors* 2016;62:25–34. <https://doi.org/10.1016/j.addbeh.2016.06.008>.
- [20] Suffoletto B, Kristan J, Chung T, Jeong K, Fabio A, Monti P, et al. An Interactive Text Message Intervention to Reduce Binge Drinking in Young Adults: A Randomized Controlled Trial with 9-Month Outcomes. *PLOS ONE* 2015;10:e0142877. <https://doi.org/10.1371/journal.pone.0142877>.
- [21] Suffoletto B, Callaway CW, Kristan J, Monti P, Clark DB. Mobile phone text message intervention to reduce binge drinking among young adults: study protocol for a randomized controlled trial. *Trials* 2013;14:93. <https://doi.org/10.1186/1745-6215-14-93>.
- [22] Suffoletto B, Kristan J, Chung T, Jeong K, Fabio A, Monti P, et al. An interactive text message intervention to reduce binge drinking in young adults: a randomized controlled trial with 9-month outcomes. *PLOS ONE* 2015;10:e0142877. <https://doi.org/10.1371/journal.pone.0142877>.
- [23] Mason M, Benotsch EG, Way T, Kim H, Snipes D. Text messaging to increase readiness to change alcohol use in college students. *J Primary Prevent* 2014;35:47–52. <https://doi.org/10.1007/s10935-013-0329-9>.
- [24] Sethuraman SC, Kompally P, Mohanty SP, Raju BK, Cruz MV. Cleo: smart glasses to monitor consumption of alcohol and cigarettes. *SN COMPUT SCI* 2022;4:53. <https://doi.org/10.1007/s42979-022-01471-9>.
- [25] Ajzen I. The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 1991;50:179–211.
- [26] Ajzen I, Fishbein M. Attitude-behavior relations: a theoretical analysis and review of empirical research. *Psychological Bulletin* 1977;84:888–918. <https://doi.org/10.1037/0033-2909.84.5.888>.
- [27] Ajzen I. Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *J Applied Social Psychol* 2002;32:665–83. <https://doi.org/10.1111/j.1559-1816.2002.tb00236.x>.
- [28] Rauschnabel PA, Hein DWE, He J, Ro YK, Rawashdeh S, Krulikowski B. Fashion or technology? A fashionology perspective on the perception and adoption of augmented reality smart glasses. *I-Com* 2016;15:179–94. <https://doi.org/10.1515/icom-2016-0021>.
- [29] Bundy C. Changing behaviour: using motivational interviewing techniques. *J R Soc Med* 2004;97:43–7.
- [30] Tenholt J, Adam S, Laun M, Schiefer C, Terschüren C, Harth V, et al. Influences of smart glasses on postural control under single- and dual-task conditions for ergonomic risk assessment. *Biomedical Engineering / Biomedizinische Technik* 2023;68:545–52. <https://doi.org/10.1515/bmt-2022-0404>.
- [31] Karassa FB, Tatsioni A, Ioannidis JPA. Design, quality, and bias in randomized controlled trials of systemic lupus erythematosus. *The Journal of Rheumatology* n.d.
- [32] Makhortykh M, Urman A, Gil-Lopez T, Ulloa R. To track or not to track: examining perceptions of online tracking for information behavior research. *Internet Research* 2021;32:260–79. <https://doi.org/10.1108/INTR-01-2021-0074>.
- [33] Rader E. Awareness of behavioral tracking and information privacy concern in facebook and google n.d.

- [34] Nguyen DH, Hayes GR. Information privacy in institutional and end-user tracking and recording technologies. *Pers Ubiquit Comput* 2010;14:53–72. <https://doi.org/10.1007/s00779-009-0229-4>.