
SoberDiary: A Phone-based Support System for Assisting Recovery from Alcohol Dependence

Kuo-Cheng Wang

National Taiwan University
r01922030@csie.ntu.edu.tw

Yi-Hsuan Hsieh

National Taiwan University
r00922022@csie.ntu.edu.tw

Chi-Hsien Yen

National Taiwan University
b98901112@ntu.edu.tw

Chuang-Wen You

National Taiwan University
cwyoun@ntu.edu.tw

Yen-Chang Chen

National Taiwan University
b98902090@csie.ntu.edu.tw

Ming-Chyi Huang

Taipei City Psychiatric Center
mch@tpech.gov.tw

Seng-Yong Lau

National Taiwan University
sylau@ntu.edu.tw

Hsin-Liu (Cindy) Kao

Massachusetts Institute of
Technology
cindykao@media.mit.edu

Hao-Hua Chu

National Taiwan University
hchu@csie.ntu.edu.tw

Abstract

Alcohol dependence is a chronic disorder associated with severe harm in multiple areas, and relapsing is easy despite treatment. After alcohol-dependent patients complete alcohol withdrawal treatment and return to their regular lives, they face further challenges in order to maintain sobriety. This study proposes SoberDiary, a phone-based support system that enables alcohol-dependent patients to self-monitor and self-manage their own alcohol use behavior and remain sober in their daily lives. Results from a 4-week user study involving 11 clinical patients show that, using SoberDiary, patients can self-monitor and self-manage their alcohol use behavior, reducing their total alcohol consumption and the number of drinking or heavy drinking days that occur following intervention.

Author Keywords

Mobile support system; recovery from alcohol dependence.

ACM Classification Keywords

D.4.m [Information Systems Applications]:
Miscellaneous.

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the Owner/Author. Copyright is held by the owner/author(s).
UbiComp'14 Adjunct, September 13-17, 2014, Seattle, WA, USA
ACM 978-1-4503-3047-3/14/09.
<http://dx.doi.org/10.1145/2638728.2638847>

Introduction

Alcohol dependence is a debilitating psychiatric disorder worldwide. A recent study [7] demonstrated that, among a range of drug-related causes of harm, alcohol is the most harmful drug (overall harm score: 72), followed by heroin (55), in all areas concerning physical harm, mortality, mental malfunction, etc. In addition, up to 50% of patients treated for alcohol dependence experience relapse in the 2 years following treatment, even after achieving abstinence [4]. Therefore, this study proposes a phone-based support system, called SoberDiary, that helps alcohol-dependent patients maintain sobriety in their daily lives following completion of alcohol withdrawal treatment.

Previous researchers [1, 5] have identified mobile phones as a platform for extending the well-proven treatment of cognitive behavioral therapy (CBT). However, these systems either did not incorporate breathalyzers to facilitate patients to monitor patients' drinking behavior during the study [5] or did not provide real-time progress feedback that visualizes patients' personal progress on their phones [1]. Further, results in [5] only present patients' application use behavior without discussing how well patients maintain sobriety and the study conducted in [1] excluded alcohol-dependent patients.

Therefore, SoberDiary uses a Bluetooth breathalyzer (shown in Fig. 1) to wirelessly connect with the SoberDiary client installed on their phones. Patients can perform breath alcohol tests to self-monitor their own alcohol use. To motivate behavioral change, SoberDiary also records personal progress and achievement in maintaining sobriety for patients to

review. All test results and momentary feedback sampled by the SoberDiary client are used to provide appropriate suggestions for reducing alcohol cravings and uploaded to a remote backend server to enable continuous patient monitoring. Because recovery support is always available via patients' smartphones, this phone-based system has the potential to continue aftercare treatment and improve the effectiveness of existing alcohol treatment programs.

The SoberDiary System

The SoberDiary system consists of three components, (1) a portable Bluetooth breathalyzer, (2) a phone application, and (3) a backend server. These components are described as follows.

Portable Bluetooth Breathalyzer

Fig. 1 shows the front, left side, and right side of the Bluetooth breathalyzer, which measures patients' breath alcohol concentration (BrAC). When a patient breathes into the straw, the BrAC readings are sent back to the patient's smartphone through a built-in Bluetooth module. Further, users can easily recharge the breathalyzer, powered by a lithium-ion battery, through a USB interface.

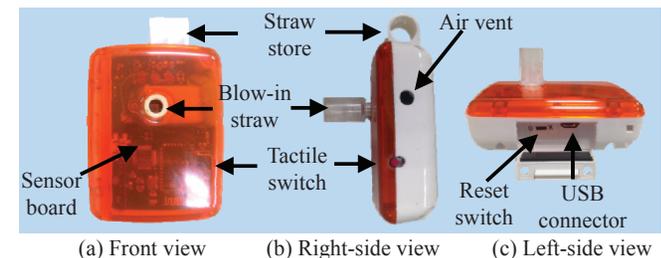


Figure 1: Photos of the Bluetooth breathalyzer.

Phone Application: SoberDiary

The architecture of the SoberDiary client consists of (1) a user interface, (2) a supporting functional module, and (3) a behavioral data store. These modules are described as follows.

User interface. The user interface is used to guide patients in performing tests and reviewing personal progress. Three full-screen pages were designed, and patients can easily switch between these pages to perform breath alcohol tests, review personal progress, share their recovery process, acquire managing skills, and input current emotions.

Supporting functional module. The supporting functional module contains five major functional blocks facilitating patients to self-manage their addictive behavior, suggest proper relapse prevention skills to reduce alcohol cravings, and promote their self-fulfillment.

The *alcohol use detection* block guides patients in turning on breathalyzers to send BrAC results to (or receive control signals from) the phone. After establishing the connection between the phone and the breathalyzer, this functional block directs patients to complete a breath alcohol test, input their emotion and craving indices, and, optionally, upload their current locations.

The *progress feedback* block enables patients to review their personal progress in alcohol recovery, motivational incentives rewarded when maintaining sobriety or using the app, and the ranking of patients in relation to other patients according to how well they perform during alcohol recovery as shown in Fig. 2.

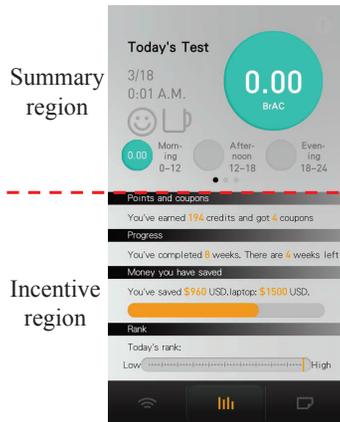


Figure 2: A screenshot of the statistical page.

The *storytelling visualization* block incorporates the principles of the 12-step program [6] in depicting a story of the struggle with alcohol on the phone to enable patients to learn the concepts associated with each step, thereby promoting their self-fulfillment to recognize values and beliefs of community and self as shown in Fig. 3.

The *managing skill suggestion* block suggests management (or preventing) skills for managing (or preventing) alcohol lapses and relapses. According to current breath alcohol test results and momentary emotion and craving indices, the app helps patients manage or resist alcohol cravings based on Marlatt's relapse prevention model [3].

The *mood sampling* block samples emotions and their triggers to identify patients' negative thinking. To prevent negative moods, identifying and addressing the negative feedback is crucial. Using their smartphones, patients can record triggers of their negative moods when experiencing symptoms of depression and anxiety through ecological momentary assessment (EMA) [2].

Behavioral data store. The behavioral data store is a database on the phone that stores patients' alcohol use data (i.e., testing results and momentary feedback, namely emotion and craving indices and emotional triggers). To enable continuous monitoring of the patients, the data store uploads the behavioral data to the backend server for future analyses.

Backend Server

A backend server was set up to receive behavioral data uploaded from patients' phones for future analysis and continuous monitoring. To provide information on how

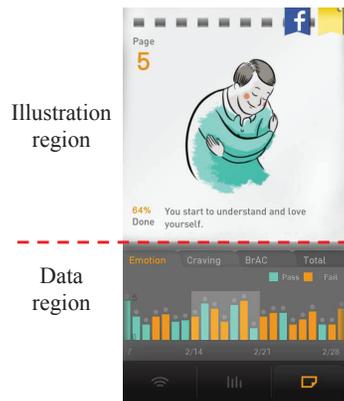


Figure 3: A screenshot of the storytelling page.

well other patients perform, the server tracks the rankings of peers' achievements in alcohol recovery. Furthermore, a monitoring web service was deployed to continuously monitor all data uploaded by patients and provide the researchers and psychiatrists with a daily summary including the details of patients who did not perform adequately (e.g., patients who did not complete the tests).

User Study

To explore the feasibility and potential of SoberDiary in assisting patients to self-monitor and self-manage in daily lives, we conducted a 4-week user study by recruiting 11 alcohol-dependent patients. Each patient was given a Bluetooth breathalyzer. The breathalyzer was paired with the participant's smartphone, on which the SoberDiary app was installed. The evaluation procedure consisted of (1) a screening phase to test the qualification of interested individuals, and (2) a 4-week intervention phase using SoberDiary. During the study, the frequency and quantity of alcohol consumption derived from data on the backend server were collected and compared with those recalled by the participants in medical reviews using the timeline follow-back (TLFB) method. Results show that patients can use SoberDiary for self-monitoring by completing 2.4 tests per day while missing only 0.17 tests per day. Further, SoberDiary effectively assisted patients maintaining sobriety, and therefore significantly decreased patients' total alcohol consumption and the number of drinking and heavy drinking days by 96.5%, 82.3%, and 86.5%, respectively.

Future Work

Our future plans are to refine the design of the SoberDiary client and to conduct a randomized

controlled trial with a greater number of alcohol-dependent participants to further demonstrate the effectiveness of SoberDiary.

References

- [1] Alessi, S. M., and Petry, N. M. A Randomized Study of Cellphone Technology to Reinforce Alcohol Abstinence in the Natural Environment. *Addiction* 108, 5 (May 2013), 900–909.
- [2] Cohn, A. M., Hunter-Reel, D., Hagman, B. T., and Mitchell, J. Promoting Behavior Change from Alcohol Use through Mobile Technology: The Future of Ecological Momentary Assessment. *Alcohol. Clin. Exp. Res.* 35, 12 (Dec 2011), 2209–2215.
- [3] G. Alan Marlatt, D. M. D. *Relapse Prevention, Second Edition: Maintenance Strategies in the Treatment of Addictive Behaviors*. The Guilford Press, 2007.
- [4] McKay, J. R., Franklin, T. R., Patapis, N., and Lynch, K. G. Conceptual, Methodological, and Analytical Issues in the Study of Relapse. *Clin. Psychol. Rev.* 26, 2 (Mar 2006), 109–127.
- [5] McTavish, F. M., Chih, M. Y., Shah, D., and Gustafson, D. H. How Patients Recovering from Alcoholism Use a Smartphone Intervention. *J. Dual Diagn.* 8, 4 (2012), 294–304.
- [6] Nowinski, J. *Twelve Steps Facilitation Therapy Manual: A Clinical Research Guide for The Therapists Treating Individuals with Alcohol Abuse and Dependence*. Diane Publishing Company, 2010.
- [7] Nutt, D. J., King, L. A., and Phillips, L. D. Drug Harms in the UK: A Multicriteria Decision Analysis. *Lancet* 376, 9752 (Nov 2010), 1558–1565.