

Examining Perceptions of a Smartphone-Based Intervention System for Alcohol Use Disorders

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Abstract

Background: This study presents results from qualitative interviews conducted with participants in a study on the effectiveness of the Location-Based Monitoring and Intervention System for Alcohol Use Disorders (LBMI-A), a smartphone-based, stand-alone intervention application (app) for adults with alcohol use disorders. **Materials and Methods:** Participants were provided an LBMI-A-enabled smartphone to use during a 6-week pilot study. The LBMI-A was composed of psychoeducational modules, assessment and feedback of alcohol use patterns, geographic high-risk location monitoring and alerts, and in vivo assessment and intervention for alcohol cravings and help with managing psychological distress. Semistructured interviews were conducted with all participants following 6 weeks of interacting with the LBMI-A app (n=26). Interviews explored user perceptions of the ease and utility of LBMI-A features, module helpfulness, barriers to use, and recommendations for improvements to the program. Researchers applied a systematic qualitative coding process to transcripts that included both a priori themes identified as important by the research team and new themes that emerged during the coding process. **Results and Conclusions:** Narrative analysis found the emergence of five main themes identified by LBMI-A users as the most helpful functions of the phone: (1) Awareness, (2) Accountability, (3) Skill Transference, (4) Tracking Progress, and (5) Prompts. These themes are explored, and implications of these findings for future smartphone-based interventions are discussed.

Key words: telehealth, telecommunications, telepathology, behavioral health

Introduction

Approximately 30% of adults between 18 and 44 years of age have met criteria for an alcohol use disorder at some point in their lives,¹ yet it has been found that less than 10% of these individuals receive treatment.¹ There are often multiple barriers for individuals seeking alcohol treatment, with stigma topping the list.² Contemporary technological tools such as smartphones have great potential to circumvent the existing barriers to treatment because of increased accessibility and affordability, poten-

tially providing needed assistance to large numbers of individuals who otherwise would not receive assistance with an alcohol problem. They also provide opportunities for real-time monitoring and delivery of substance use interventions in the contexts in which they are needed most. For instance, this smartphone application (app), the Location-Based Monitoring Invention for Alcohol Use Disorders (LBMI-A), can be utilized in a parking lot of a bar when a user is considering going in for a drink or when he or she is having a craving to drink. Research has demonstrated that Internet-based alcohol treatment programs can be effective in reducing alcohol consumption among problem drinkers and among younger populations at risk for developing alcohol use disorders.³⁻⁷ Mobile technologies are bridging the digital divide (i.e., the gap between those who use technology and those who do not).⁸ These technologies are increasingly accepted as tools for self-monitoring and providing continuous support for health behavior change and relapse prevention of substance use.⁹⁻¹⁴

The primary aims of the current study were to develop and pilot test a smartphone-based intervention app among individuals with an alcohol use disorder.

Materials and Methods

The LBMI-A intervention, dubbed “Buddy” for participants, provided a self-administered, portable alternative to traditional alcohol treatment. The design of the LBMI-A intervention was informed by numerous theoretical perspectives: namely, motivational enhancement,¹⁵ relapse prevention,¹⁶ and community reinforcement.^{17,18} The LBMI-A app used a stepwise approach to introduce the intervention modules and related tools. It also provided continual feedback and support to the participant. Reminders and other functionality provided the participant with structure and strategies for managing drinking-related problems. Participants were compensated with two \$60 gift cards and an opportunity to receive \$5 per day for each day that they completed an assessment during the course of the 6-week study. The LBMI-A project was completed with full Institutional Review Board review from the University of Alaska, Anchorage. Additional details about the development and specific functionality of the LBMI-A and its empirical foundation can be found in an earlier publication.¹⁹

In brief, the LBMI-A provided 10 psychoeducational modules and tools for change that were all based on empirically supported interventions. Upon completion of each module, users were able to access an associated tool. Tools provided immediate coping strategies and monitoring functions for numerous alcohol-related issues. The LBMI-A program included a total of 10 immediately available tools designed to help individuals reduce their drinking (*Table 1*).

Table 1. Tools and Functions

NAME OF TOOL	FUNCTIONS OF TOOL
Initial Feedback	Provided initial feedback after the intake interview on normative drinking, alcohol dependence, and consequences
Cravings Tool	Provides monitoring of cravings when they occur and craving strategies
Daily Interview	Daily interview about cravings and alcohol consumption
Drink Monitor	Immediate monitoring of continued alcohol use
High Risk Locations	GPS functionality provides an alert when the user is near a high-risk location for drinking
Pleasurable Activities	Provides an interactive list of nondrinking, pleasurable activities
Problem Management	Teaches problem management strategies and provides stepwise problem-solving functionality
Productive Communication	Provides instruction on productive communication strategies
Reminder Photos	Encourages participant to enter and view photos that serve as reminders of why the person has chosen to stop drinking
Supportive Person	Provides functionality for the user to link up with support persons electronically
See Dulin et al. ¹⁹ for a complete overview of the LBMI-A development. GPS, global positioning system.	

For the current pilot study, both quantitative and qualitative data were collected from participants. Quantitative outcomes from the current pilot study, which compared pre–postintervention usage of LBMI-A, showed that participants who used the LBMI-A app demonstrated a significant reduction in hazardous alcohol use and a decrease in the number of drinks per day.²⁰ Prior to using the LBMI-A, participants indicated heavy drinking (5 drinks per day for males, 4 for females) on 56% of days, an average of 5.6 drinks per day. After using the LBMI-A app for 6 weeks, participants reported heavy drinking on 25% of days, with an average of 2.9 drinks per day. These findings showed a statistically significant reduction among participants while using the LBMI-A program for 6 weeks compared with their baseline drinking.²⁰

This article presents results from qualitative interviews that were conducted with study participants who used the LBMI-A app for the 6-week pilot study. This study focused on the subjective experience of using the LBMI-A app to change participants' drinking. Specific questions addressed in this article include the following: (1) Which features of the LBMI-A app did people find helpful in changing their drinking? (2) What was it about these features that people found helpful? (3) What are the recommendations for maximizing the perceived usefulness of mobile interventions for problematic alcohol use?

PARTICIPANTS

Participants in the LBMI-A pilot study were recruited using radio, newspaper advertisements, and flyer advertisements. Participants were eligible for the study if they were not receiving alcohol or drug treatment elsewhere, were at least minimally motivated to change their drinking (i.e., University of Rhode Island Change Assessment²¹ score indicating a contemplation stage of change or higher), were currently drinking heavily (e.g., more than 14 drinks per week for women and more than 21 drinks per week for men), met DSM-V diagnostic criteria for an alcohol use disorder but did not meet criteria for bipolar disorder or psychosis, and did not have another substance abuse or dependence disorder (excluding nicotine or marijuana). Further eligibility criteria included having a basic working knowledge of technology (knows how to text using a cell phone and uses e-mail). Additional exclusion criteria included being currently engaged in any form of additional substance abuse treatment, being pregnant or nursing, being legally mandated to attend treatment, needing alcohol or drug detoxification as defined by a score of 11 or above on the Revised Clinical Institute Withdrawal Assessment for Alcohol Scale,²² or evidence of severe alcohol dependence as indicated by a score of 30 or above on the Severity of Alcohol Dependence Questionnaire Form-C.²³

A subset of 28 individuals was enrolled in the study and received the LBMI-A for 6 weeks. Participants' ages ranged from 22 to 45 years (mean, 33.6 years; standard deviation, 6.5), and 53.6% ($n = 15$) were male. All participants had at least a high school-level education. Of the 28 participants who completed the LBMI-A intervention, 26 participated in a qualitative interview, which took place between December 2011 and March 2012, after the participants had used the app for 6 weeks. The qualitative interviews were guided by predetermined questions generated by the research team. These questions asked for the participants to describe and discuss their overall experiences with the LBMI-A program (e.g., likes and dislikes) as well as their experiences with each of the specific features of the program.

METHODS

Interviews were audiorecorded and transcribed verbatim by a member of the research team. Participants' names were replaced by a researcher-selected identification number, and all other identifying information (i.e., names of people and places) was omitted. Transcripts were then reviewed for accuracy. A comprehensive set of *a priori* (e.g., based on specific questions asked during the interview), and emergent codes were identified by the research team. Members of the research team collectively coded two transcripts in order to clarify the definition and parameters of all of the codes. Once the code book had been refined and clarified, all transcripts were imported into a qualitative research data analysis program (NVivo 9).²⁴ To establish intercoder reliability and validity, all subsequent interview transcripts were separately coded by at least two different research team members. Narrative segments that were not identically coded by the team members were identified, discussed, and justified for inclusion or exclusion in the data set.

Results

Twenty-two unique codes reflected user comments about each feature of the phone, as well as overall themes about what users found useful. Five major themes emerged from the data that demonstrated factors related to helpfulness of the LBMI-A app. These five themes included raising awareness about drinking (Awareness), prompts the LBMI-A app generated to use the LBMI-A program features (Prompts), teaching new skills that could be transferred to other areas of their life (Skill Transference), tracking progress related to their goals (Tracking Progress), and providing accountability for drinking (Accountability).

AWARENESS

Overall, the most prominently mentioned code by participants was Awareness. Awareness was discussed 52 separate times throughout the dataset and was mentioned by 22 participants. Awareness was mentioned in two different ways (i.e., increased awareness of drinking patterns and increased awareness of cravings). First, participants reported that LBMI-A helped raise awareness of what constitutes problem drinking and the quantity of alcohol they were consuming. For example, participant 127 discussed the use of the daily interview to raise his awareness about drinking:

I like it, and I like to look at the feedback on the system. It kinda [sic] makes you realize things you don't normally think about. How many total, when it adds up. Shows you the big picture of it and makes you think. I never thought about it, I never thought it would be that large.

Participants often reported that when they entered in the information they were surprised by the amount they actually drank and that this new awareness motivated them to change their drinking. For example, participant 174 describes her experiences:

I think primarily just the feedback responses that I was given and some of the initial feedback was just kind of eye opening, just so that I was like, alright, I need to do something to cut back a little bit.

Second, participants reported that the app helped to raise their awareness about their cravings. Participant 137 describes how awareness about her cravings also helped her to select pleasurable activities that she could do instead of drinking:

Being able to put in those cravings and look at if you drank that day. It helped.

Interviewer: So what I'm hearing is that you didn't think that the phone was going to help, but then it did? Okay, what did it help?

[The phone] gave me something else to do. It showed me how much I was drinking, and I was drinking too much, and then it helped me realize there were other things I could do besides drink.

Furthermore, raising awareness appeared to assist participants in creating changes within their daily lives. For example, participant 184 described a behavior change as a result of increased awareness:

Like I said, it put, it kinda [sic] put the information into perspective and it made me think about it a lot more. You know, before I mean I was aware obviously. I selected myself to come in here. But it did make me more aware, like every single time that I did go to drink or go to buy something I would just be more aware of it. I mean I don't know how much it necessarily helped. But it definitely at least made me more aware of it, which I think is an impact.

PROMPTING

Another common theme throughout the transcripts was that of prompting. Prompts were mentioned 23 separate times by 15 participants during the interviews. The LBMI-A provided various prompts that encouraged participants to enter their number of drinks each day or reminded them to use specific features of the phone. Participants indicated that they liked prompts that the LBMI-A provided because these helped them to stay engaged with using the program, as illustrated in the following transcription:

Interviewer: So even if you'd had a prompt, you think you would have forgotten?

Respondent 137: No no, if there wasn't a prompt, I probably would have forgotten to do it.

Several participants suggested that an increase in the amount of prompts provided by the program would be beneficial. For example, participant 165 describes how he would have liked more prompting to complete his daily interview:

It might help to have more prompts, like it would come up, it will let you put on there like a time of day you want to be reminded to do your daily interview. It would probably help to have, you know, just reminders to pop up every once in a while. Like, hey, don't forget about this feature."

SKILL TRANSFERENCE

The ability to transfer skills learned on the LBMI-A program to daily life activities was mentioned 13 separate times by 10 participants. The LBMI-A program presented several tools for participants to use that would introduce participants to a particular skill set. For example, the program included a pleasurable activities tool that recommended pleasurable things that participants could do instead of engaging in drinking. In general, participants felt that the information and practice provided by the pleasurable activities tool helped them to engage in more pleasurable activities in their daily life. For example, participant 129 describes this:

Only when I first started. I just saw the list and was aware of things I could do instead, which I did do actually."

Interviewer: So even if you didn't put it into the calendar in Buddy you did them?

Yeah.

Participant 130 also describes how he was able to transfer the skills learned in the pleasurable activities application into his daily life:

It made me think of different things that I didn't [use to] think of whenever I was bored that I could do instead of choosing to drink.

Interviewer: Oh great.

You know, nobody really likes to clean their house, but it keeps your mind busy. Or you put your own add-ons to things you like to do, like beading. I haven't beaded in like two years.

Interviewer: Oh, that's cool.

So it helped me remember different things that I liked to do. I scrolled through all of the ones that I had on there and picked the ones I liked. So even though I didn't use the tool, I used the tool.

TRACKING PROGRESS

The LBMI-A's ability to track the progress of participant success was noted 16 separate times by 10 participants. In particular, participants liked how the daily interview and the weekly feedback helped them to keep track of their progress:

Respondent 198: The feedback and the interviews and stuff, it made me stop and think I guess, and actually have a visual to look at. I was like "oh, look how good I'm doing I'm gonna [sic] keep going," or "Oh, look how bad I did I got to get back on track." That was my favorite part that it made me stop and think.

In general, participants indicated that tracking progress allowed them to set goals for themselves and boosted their confidence when they could look back and see improvement. Overall, this process created motivation to continue engaging in nondrinking behavior because it was rewarding:

Respondent 204: Putting in the daily interview. That was confidence every day that it came up and said do your interview, and I put down zero, and it says did you have any or are you telling the truth. I was like, I'm telling the truth, I had no drinks, and now, you're in your head telling yourself, "Holy shit! I just went a whole day without having a drink!" And then it shows you in the past, I haven't had a day and you count it up, and it's always in your head how many days you've gone without. That was really...it really builds your confidence a lot.

ACCOUNTABILITY

Finally, some participants mentioned that entering information into the phone app held them accountable for their drinking behavior. Accountability was mentioned seven separate times by five participants. Overall, participants reported that knowing they had to enter the number of drinks they had into their phone helped create accountability for their drinking and as a result served as a deterrent. For example, participant 177 describes this experience:

Yeah, like having to, for me, having to physically, I mean no one is watching me but I'm like recording it, you know what I mean. It's like I'm saying, I'm like admitting what I'm doing wrong.

Interviewer: What was that like?

Um, it just, it made me stop and think. I thought, you know, "Well if I have these drinks, I'm going to have to put it in the phone."

Interviewer: So it kind of held you accountable a little bit?

Yeah. Like I'm writing it down. Or, I'm like...like a little diary. When you keep track of it, or anything. Keeping track of it like that, you realize, usually it seems like it's either less or more than you thought. So, it's just kind of, not painful, but it was kind of annoying to see, you know.

The LBMI-A app was administered on a preprogrammed smartphone (running Windows Mobile), which was given to all participants to use during the study period. Therefore the program was not available on participants' own phones or as an app for use on another smartphone. A prominent code throughout the dataset was the code for Phone App, which was used any time participants mentioned that they would have liked the program to appear on their own phone. Overall, having the LBMI-A program as an app on their own phone was mentioned 55 separate times by 22 participants. In general, participants felt that the program would have been more useful and that they would have been more likely to use it more regularly if it existed on their personal phone. Participants noted that it was difficult to carry two phones around with them (i.e., their own phone and the LBMI-A phone), which sometimes served as a deterrent to its use. One important purpose of this study was to determine how participants used the LBMI-A app in order to better inform future iterations of the app. The LBMI-A app is currently in the process of revision, which makes it more readily available for use on one's personal phone.

Discussion

Results from this study generated numerous themes related to how users perceived the helpfulness of the LBMI-A and how it could be improved in future versions. A prominent theme of this qualitative analysis was the LBMI-A's effectiveness in raising awareness about the extent to which participants were drinking and their personal drinking patterns and triggers. It has been documented that a lack of awareness regarding drinking habits is a barrier to behavior change.²⁵ Furthermore, raising awareness about drinking patterns, through the use of personalized feedback, has been shown to effectively reduce drinking among problem drinkers.²⁰ However, the use of technology to raise awareness has not yet been fully examined. Among college students, it has been demonstrated that written and computerized personalized feedback was more effective than face-to-face feedback.^{26,27} Participants of the LBMI-A study frequently indicated that raising awareness through personalized feedback was one of the most beneficial aspects of the LBMI-A app in helping them to change their drinking patterns.

Another important theme that emerged was the importance of daily tracking and feedback on participant progress. Although response to these features was positive, participant interviews

suggested that they could have been more influential by capitalizing on the motivational aspects of seeing progress over time. Participants reported that it was helpful to view their progress in reducing the number of drinks per week and that more feedback would have been warranted. They also indicated that tracking progress helped to enhance motivation to continue reducing their drinking, which is consistent with findings from other technology-based behavior modification programs. For example, a review of the literature regarding the use of videogames to increase healthy diet and exercise found that programs that allowed users to create and track their own fitness goals were more successful than programs with prescriptive goals.²⁸ Allowing participants to select and track their own goals appears to be a key component of technologically based interventions.

The feedback provided to participants by the LBMI-A was primarily composed of text with few visuals and little graphically represented information. It is possible that enhanced feedback that is visually engaging and easily interpreted may improve the efficacy of LBMI-A and other technology-based interventions by bolstering motivation to continue with treatment. Research conducted on technologically delivered self-management of chronic diseases shows that graphs and other forms of engaging feedback have been well received by participants and proven to be among the most efficacious elements of this type of intervention.²⁹⁻³² Therefore, mobile technology-based intervention users also may benefit from the use of graphs and engaging feedback.

The tracking features of LBMI-A also appeared to increase accountability for some users by requiring them to enter the number of drinks they had on a daily basis. Participants reported avoiding drinking because it was aversive to enter their number of drinks into the LBMI-A app the following day and face the discrepancy between their goals and their behavior. In this regard, the LBMI-A program functioned as a continual reminder that they had a goal to drink less and that it would be necessary to admit (even to a smartphone) that they were not living up to a standard they had set for themselves. This finding appears consistent with findings from other technology-based interventions in which being held accountable for tracking a target behavior lead to significant behavior modification and improved health outcomes.³² Literature shows that enhanced accountability can also be achieved through use of public forums and social media.³³

An unexpected finding of the current project related to the extent to which participants responded favorably to the prompts that the LBMI-A provided. Rather than finding them intrusive, as has been found in other studies that used ecological momentary assessment to prompt behavior change,³² participants reported that they appreciated them and suggested that the prompts helped them to stay engaged with the app. They specifically indicated that the prompts were helpful in reminding them to complete the daily interviews. This is consistent with Internet-based interventions that have found that incorporating prompts to engage the user in the prescribed behaviors was beneficial and helped aid in behavior change, particularly for smoking cessation and substance use interventions.³⁴⁻³⁶ The prompts

provided by the LBMI-A program were a very basic text message in standard gray and black text. Given the large percentage of participants who reported liking the prompting feature of the phone, it may be worthwhile for future programs like the LBMI-A to develop more rich and engaging prompts for users.

The LBMI-A appears to have helped participants transfer skills from the strategies they encountered in the LBMI-A steps to their life. In particular, participants found it helpful to use the LBMI-A to create a pleasurable activity plan that they could use during times that they would have previously been drinking. Participants indicated that even if they did not enter new activities into their calendar, they were more likely to do them simply by having seen the activities as possibilities; to paraphrase one participant, "using the tool, without using the tool." A similar example comes from findings related to the LBMI-A supportive person tool. Participants reported that being prompted to seek support from friends and family members was related to improved supportive relationships, but that they rarely formally added them as a supportive person in the LBMI-A. It appears that people engaged in numerous new treatment-relevant behaviors and activities even though they did not necessarily schedule them into the LBMI-A. They utilized friends and family for support but did not go through the Supportive Person Tool to formally enter them as "Buddy Support People." It is likely that some people will use these tools exactly as they were intended, but that others will incorporate new behaviors as a result of the app having introduced the idea.

In addition to indicating that the LBMI-A reduced overall drinking by more than 50% and hazardous drinking by approximately 60%, the pilot study quantitative results also indicated that overall use of the system was related to decreased drinking.²¹ Results of this study suggested numerous opportunities for increased user engagement, which is perhaps one of the key issues in successful technology-based behavior change interventions. A substantial barrier to increased system use emerged regarding having provided participants with an external phone to use. Most participants reported that they left the "study phone" at home because of the inconvenience of carrying two phones. At this point in time, approximately 60% of the U.S. population owns a smartphone, and this proportion is increasing rapidly,³⁷ indicating that many individuals can now be reached with downloadable apps. During the development phase of the LBMI-A, smartphone apps were not at a stage that could provide the complicated functionality of the LBMI-A, but they now can easily handle LBMI-A-type features. Given these trends and the importance of user engagement, future development efforts should focus on providing downloadable apps that users can seamlessly integrate into their daily lives on their personal devices.

LIMITATIONS

There are inherent limitations of conducting qualitative research on a technology-based intervention with regard to being able to generalize findings to those of other smartphone-based interventions. Although qualitative data are useful to enrich understanding of how and why individuals use technology-based programs, the interview questions used in this study may have been too specific to the

features of the LBMI-A program. Including more open-ended, broad-base questions may have yielded more generalizable themes for smartphone-based interventions to address substance use disorders, as well as other health behavior change programs that face similar barriers.

Conclusions and Recommendations

Overall, use of the LBMI-A system was successful in helping individuals to learn intervention strategies that they could transfer to their daily lives, and it appeared to help them to stay on track with their goals. Participants reported that they liked that the LBMI-A program prompted them to use the phone app, held them accountable for entering drinking information into the phone app, raised their awareness about drinking behaviors, and allowed them to track progress toward their personal goals. Future research should examine the role of mobile technologies in raising drinking awareness by providing opportunities for ecological momentary assessment and interventions. Additionally, participants in this study liked tracking their progress toward their personal goals during the 6-week pilot. The longer-term potential of tracking progress using mobile technology for substance use should be further examined.

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Disclosure Statement

P.D. is the owner of a company that has developed a commercially available iPhone app called Step Away. The development of Step Away was partly informed by results from this study. D.G., S.B., D.K.K., and V.G. declare no competing interests exist.

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