



Published in final edited form as:

*Subst Abus.* 2014 ; 35(2): 168–175. doi:10.1080/08897077.2013.821437.

## Results of a Pilot Test of a Self-Administered Smartphone-Based Treatment System for Alcohol Use Disorders: Usability and Early Outcomes

Patrick L. Dulin, PhD<sup>1</sup>, Vivian M. Gonzalez, PhD<sup>1</sup>, and Kendra Campbell, PhD<sup>2</sup>

<sup>1</sup>Department of Psychology, University of Alaska, Anchorage

<sup>2</sup>San Francisco VA Medical Center

### Abstract

**Background**—This paper provides results from a pilot study focused on assessing early-stage effectiveness and usability of a smartphone-based intervention system that provides a stand-alone, self-administered intervention option, the Location-Based Monitoring and Intervention for Alcohol Use Disorders (LBMI-A). The LBMI-A provided numerous features for intervening with ongoing drinking, craving, connection with supportive others, managing life problems, high risk location alerting and activity scheduling.

**Methods**—Twenty-eight participants, ranging in age from 22 to 45, who met criteria for an alcohol use disorder used an LBMI-A enabled smartphone for 6 weeks.

**Results**—Participants indicated the LBMI-A intervention modules were helpful in highlighting alcohol use patterns. Tools related to managing alcohol craving, monitoring consumption, and identifying triggers to drink were rated by participants as particularly helpful. Participants also demonstrated significant reductions in hazardous alcohol use while using the system (56% of days spent hazardously drinking at baseline vs. 25% while using the LBMI-A) and drinks per day diminished by 52%.

**Conclusions**—Implications for system improvement as well as suggestions for designing ecological momentary assessment and intervention systems for substance use disorders are discussed.

### Keywords

self-administered; alcohol intervention; smartphone; usability; M-health

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Corresponding Author: Patrick L. Dulin, Department of Psychology, University of Alaska, Anchorage, 3211 Providence Drive, Anchorage, AK 99508, afpld@uaa.alaska.edu.

#### Author Contributions:

Dr. Patrick Dulin developed the initial framework for the LBMI-A and was a co-PI on the National Institute of Alcohol Abuse and Alcoholism (NIAAA) grant that funded the completion of the original LBM-A software system and pilot study. He participated in all aspects of software system development, data collection, analyses and manuscript preparation. Dr. Vivian Gonzalez was a co-PI on the NIAAA grant and also participated in all aspects of the project. Dr. Kendra Campbell participated in data analyses and manuscript preparation.

## INTRODUCTION

In recent years, mobile health has emerged as a potential alternative to in-person healthcare. While this development brings exciting opportunities for alternative service delivery, there remains a dearth of empirical support for the development of mobile health or other e-health tools, especially in the field of mental health and substance dependence [1, 2]. This paper seeks to add to this knowledge base through providing results of a pilot study of a smartphone-delivered, stand-alone intervention for alcohol use disorders, the Location-Based Monitoring and Intervention System for Alcohol Use Disorders (LBMI-A). The LBMI-A was designed to provide a self-administered, portable alternative that holds the potential to circumvent many of the extant barriers to engaging in traditional alcohol treatment (See [3] for a complete overview of LBMI-A development). The purpose of this paper is to provide results related to a six-week trial of the LBMI-A that focused on providing information on LBMI-A features that users found particularly helpful in changing their drinking, which functions were used most frequently and how participant usage of the system changed over the six-week trial as well as providing early-stage information about its effectiveness in reducing hazardous alcohol consumption. We conclude with suggested improvements to the system based on this information.

### Mobile Health Development and Usability

There is a small but significant body of literature investigating the usability of mobile health technology. Research has consistently supported the utility of such devices for a variety of healthcare needs (e.g., depression, [4]; diabetes management, [5]; geriatric care management, [6] and weight management, [7]). With regard to technology use in alcohol intervention, research has indicated that internet-based alcohol intervention programs have been effective in reducing alcohol consumption among problem drinkers and younger populations at risk for developing alcohol use disorders [8, 9, 10, 11, 12]. These interventions also hold promise for producing lasting gains [13]. Research specific to mobile health alcohol intervention suggests that participants used cell phones in a manner consistent with the instructions and appeared to record drinking episodes when they actually took place, demonstrating that such systems can collect valid data [14]. Participant-rated usability of such devices has been largely favorable, suggesting the importance of continued development of optimally usable mobile health technology, especially in the field of mental health.

### Background for LBMI-A Development

In order to illustrate the need for continued investigation of user-friendly mobile health technology for alcohol use disorders, it is important to understand the current barriers to treatment faced by individuals affected by alcohol misuse. Of the approximately 19 million Americans over the age of 12 who meet criteria for alcohol use disorders, less than 10% receive treatment [15]. Both treatment-related and personal factors can serve as barriers to engaging in alcohol treatment. Treatment-related barriers include poor availability of services, lack of insurance, cost of treatment, the need for childcare to attend meetings, work-related complications, and transportation problems [16]. Research has indicated that the most powerful barriers to addiction treatment are related to personal attitudes about

attending a treatment facility [17, 18]. Particularly hindering to individuals in need of treatment is the stigma associated with attending a treatment facility, which can threaten an individual's sense of control and self-esteem [19]. Regardless of whether or not individuals believe that treatment will be effective in resolving or ameliorating their alcohol related problems, most people prefer to independently solve alcohol use problems instead of attending formal treatment [20]. One method for circumventing alcohol treatment barriers is through the use of mobile communications technologies such as GPS-enabled smartphones. Smartphone and other portable technology-based interventions could enhance utilization of alcohol treatment for individuals for whom traditional treatment is not a viable or preferable option.

### Brief Overview of the LBMI-A System

Development of the LBMI-A entailed a survey of current empirically supported treatments for alcoholism and selecting those that were deemed deliverable on a smartphone platform. The overall system design was informed by existing alcohol use disorder interventions such as the Combined Behavioral Intervention used in Project Combine [21]. We developed a stepwise approach to providing the information and interventions to the client that we called *Buddy Steps*. Since the acronym "LBMI-A" was considered unwieldy for participants, we gave it the name "Buddy" for use in the pilot study. Each step contained a psycho-education module that presented key concepts pertaining to the topic. The Buddy Steps included: 1) enhancement of motivation for change by providing assessment feedback [21, 22]; 2) high-risk for drinking locations and strategies for avoiding them; 3) importance of supportive people [21]; 4) managing alcohol cravings [21]; 5) managing life problems through problem solving strategies [23]; 6) pleasurable non-drinking activities [21]; and 7) productive communication strategies that emphasize assertive communication [21, 24]. Steps differed in their overall length, but most could easily be read in 15 minutes or less. The participant could also choose to listen to an audio file that corresponded to the text within the module.

Following completion of the Step by reading or listening to the psychoeducational information, the associated *Buddy Tool* became available for use (see Table 1 for Buddy Step and Tool content). The Buddy Tools provided immediate coping strategies and monitoring functions for on-going alcohol use, alcohol-related problems and functions designed to maintain motivation for change such as taking and viewing reminder photos. The Craving Tool assessed type and strength of craving and provided numerous strategies to manage the experience. The Drink Monitor Tool recorded drinking as it occurred (user pressed the icon when they were having a drink). The Problem Management Tool provided step-by-step instruction on how to directly approach a life problem. The Supportive Persons Tool allowed users to select, add and delete people who could be trusted to be of help during times of need. The High Risk Location Tool provided functionality to add a high risk for drinking location by looking up the business name or typing in the address of a house where they often drank alcohol. After high risk locations were entered, the system utilized the GPS capabilities of the smartphone to provide an audible alert and suggestions for maintaining control of drinking when they crossed a boundary around a specific high risk location. The Pleasurable Activities Tool provided numerous different categories of non-drinking activities and the ability to schedule them into a calendar. The Reminder Photos Tool

provided the ability to take a photo that reminded them of why they wanted to change their drinking and view them when they were in need of a motivational boost (for instance, viewing reminder photos was an option when the phone determined they were in a high risk location). The Daily Interview asked about the previous days drinking and craving and their triggers. The Weekly Feedback Tool aggregated information from the daily interviews to provide an outline of their progress over time.

## METHODS

### Participants

We recruited from a Northwest community of approximately 300,000 individuals using a number of different methods including radio and newspaper advertisements and flyers. Phone screenings were completed with 113 individuals. The primary reasons for ineligibility at the phone screening ( $n = 54$ ) were age (72.2%) and currently being in treatment for an alcohol or substance use disorder (16.7%). Forty-eight participants completed the eligibility/baseline assessment. Fourteen individuals did not meet eligibility for the study after this assessment. The primary reason for ineligibility was alcohol dependence severity being too high (35.7%,  $n = 5$ ). Other reasons for exclusion included: having bipolar disorder or psychotic symptoms (14.3%,  $n = 2$ ), abuse or dependence on another substance ( $n = 2$ ), being too low in motivation to change ( $n = 2$ ), not meeting alcohol consumption criteria ( $n = 2$ ), and not having an alcohol use disorder (7.1%,  $n = 1$ ).

To be included in the study participants had to be currently drinking; meet DSM-V recommended diagnostic criteria for an alcohol use disorder [25], and be at least minimally motivated to change their drinking [21] - defined as scoring above a mean of 3 on the action, contemplation or maintenance subscales of the URICA and below a mean of 3 on the pre-contemplation subscale [21]. This definition corresponded to participants not disagreeing that they had a problem with alcohol, and that there was at least a minimal interest in change. Participants also needed to be drinking a minimum of: (a) 14 standard drinks (females) or 21 drinking (males) on average per week over a consecutive 30 days period in the 90 days prior to evaluation, and (b) 2 heavy drinking days (4 or more drinks—females, 5 or more—males) in the same 30 day period as above. Further eligibility criteria included being between the age of 18 and 45 years old, having a basic working knowledge of technology (i.e., can text using a cell phone and uses email) and at least a 6<sup>th</sup> grade reading level. 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 detoxification, evidence of severe alcohol dependence as indicated by a score of 30 or above on the Severity of Alcohol Dependence Questionnaire Form-C [26], meeting DSM-IV criteria for Bipolar Disorder or psychosis, or dependence on another substance.

### LBMI-A System Delivery

When this tool was initially being developed (early 2010), the only available smartphone deemed by software engineers as programmable to the required specifications was a Windows Mobile® enabled phone. It was necessary for software engineers to perform

numerous software customizations (“hacks”) in order for the phone to carry out the required functions. It was not feasible, at that time, to create an “app” that could be downloaded onto participants’ personal smartphones. We determined it was necessary to provide participants with a customized, LBMI-A enabled smartphone (an HTC, Tilt 2®) for use during the 6-week pilot study. Participants were compensated for completing baseline and 6-week follow-up assessments and for completing a daily interview of alcohol consumption that was automatically delivered on their smartphone.

### Measurement of Alcohol Consumption

Alcohol consumption was measured at two time points, before using the LBMI-A and after 6 weeks of LBMI-A use. The Timeline Followback (TLFB) was utilized at both time periods [27]. At the pre-test, a 90-day TLFB was administered to create a drinking baseline and at the end of the 6-week pilot study, participants completed the TLFB for the 6 weeks they used the LBMI-A system.

### Usability Feedback Measures

At the end of the 6-week trial, participants completed questionnaires related to system usability. Participants responded to a tailored instrument that assessed perceived helpfulness and ease of use of both the LBMI-A tools and steps. The questionnaire specifically queried for how helpful each step or tool was in changing drinking. The helpfulness questionnaire included 10 individual ratings that assessed the helpfulness of the Buddy Tools and 6 individual ratings that assessed the helpfulness of the Buddy Steps. Each item requested the participant to rate the helpfulness of each tool or the information in each step on a 7-point Likert-type scale with 1 being extremely unhelpful (or extremely easy to use) and 7 being extremely helpful (or extremely difficult to use). A similar 7-point Likert-type scale was also used to assess ease of use of the various steps and tools with 1 being extremely difficult to use and 7 being extremely easy to use. Participants were also queried by the interviewer about what specifically the participants found helpful or unhelpful about each feature after they completed the rating scale.

Data related to actual LBMI-A system usage were also collected (user input data was sent by the smartphone to a back-end server). The system recorded each time a participant initiated each of the steps and tools with the exception of the communications step, which existed on a separate webpage as the content was deemed too extensive to be portrayed on a phone screen.

## RESULTS

Twenty-eight participants completed the six-week LBMI-A pilot study. The sample was comprised of female (46.4%,  $n = 13$ ) and male (53.6%,  $n = 15$ ) participants with an age range of 22 to 45 years ( $M = 33.6$ ,  $SD = 6.5$ ). All participants had completed high school or the GED, with 39.2% having completed an undergraduate or graduate college degree. The sample was 50.0% White, 25.0% multiethnic, 10.7% Alaska Native or American Indian, 7.1% African American, 3.6% Hispanic, and 3.6% Pacific Islander. Results of TLFB for the 90 days prior to using the LBMI-A indicated heavy drinking (5 drinks per day for males, 4

for females) on 56% of days, an average of 5.6 drinks per day, and a mean of 8.2 drinks per drinking day.

### Alcohol Outcomes

Results of paired *t*-tests from the TLFB indicated statistically significant changes in percent of heavy drinking days between the baseline and during the 6 week pilot study [56% (*SD* = .23) vs. 25% (*SD* = .30), *P* < .001], Cohen's *d* = 1.0]. Significant paired *t*-tests were also shown for mean number of drinks per day [*M* = 5.6 (*SD* = 2.9) vs. *M* = 2.9 (*SD* = 2.4), *P* < .001, Cohen's *d* = 1.1] and drinks per drinking day [*M* = 8.2 (*SD* = 3.9) vs. *M* = 6.5 (*SD* = 3.9), Cohen's *d* = .4, *P* < .01].

### Ease of Use

Results of descriptive statistical analyses indicated that overall, participants found the LBMI-A intervention tools and modules to be easy to comprehend. Participant ratings indicated that overall they found the LBMI tools moderately easy to use (*M* = 5.6, *SD* = 1.7) with the drink monitor tool being the easiest to use (*M* = 6.6, *SD* = 1.8) and the high risk locations tool being the most difficult (*M* = 4.3, *SD* = 1.6). Numerous participants indicated that the high risk locations tool was confusing and that when they carried the LBMI-A phone with them, it occasionally malfunctioned. They noted that at times the alerting function went off at the wrong place which resulted in an occasional need to disable the feature.

### Perceived Helpfulness

Results pertaining to the perceived helpfulness of the information in the LBMI-A steps in changing drinking can be seen in Figure 1. Since results suggest a positive response bias which limits the interpretability of the mean rating, we included analysis of participants who rated the tool greater than 5, which corresponds to the feature being highly to extremely helpful. Seventy one percent of participants rated the Craving Step > 5 (*M* = 5.8, *SD* = 1.0), 57% rated the Pleasurable Activity Step greater than 5 (*M* = 5.4, *SD* = 1.5), 41% rated the Supportive Persons Step > 5 (*M* = 5.3, *SD* = 1.4), 29% rated the Problem Management Step > 5 (*M* = 5.2, *SD* = 1.1), 19% rated the High Risk Location Step > 5 (*M* = 4.3, *SD* = 1.8) and 13% rated the Productive Communications Step > 5 (*M* = 4.5, *SD* = 1.7).

Regarding the perceived helpfulness of the LBMI-A tools, results indicated that 82% of participants rated the Daily Interview Tool > 5 (*M* = 6.1, *SD* = 1.1), 57% rated the Craving Tool > 5 (*M* = 5.6, *SD* = 1.3), 61% rated the Initial Feedback > 5 (*M* = 5.6, *SD* = 1.3), 57% rated the Weekly Feedback > 5 (*M* = 5.5, *SD* = 1.3), 55% rated the Drink Monitor > 5 (*M* = 5.4, *SD* = 1.5), 48% rated the Pleasurable Activities Tool > 5 (*M* = 5.2, *SD* = 1.7), 26% rated the Reminder Photos > 5 (*M* = 5.1, *SD* = 1.7), 10% rated the Problem Management Tool > 5 (*M* = 4.7, *SD* = 1.7), 28% rated the Supportive Person Tool > 5 (*M* = 4.5, *SD* = 2.2), and 17% High Risk Location Tool > 5 (*M* = 3.8, *SD* = 2.2).

### LBMI-A System Data

Data were also collected by the LBMI-A system on how often participants visited the various LBMI steps and tools. As can be seen in Figure 2, the High Risk Locations Step was

viewed most frequently ( $M = 4.3$ ,  $SD = 1.0$ ), followed by Supportive Persons Step ( $M = 3.1$ ,  $SD = 0.9$ ), Craving Step ( $M = 2.6$ ,  $SD = 0.9$ ), and the pleasurable activities Step ( $M = 1.5$ ,  $SD = 0.7$ ). Figure 2 provides information about average use of each LBMI-A tool. The Craving Tool was utilized most frequently with a mean number of 12.1 initiations ( $SD = 3.5$ ), followed by the Drink Monitor ( $M = 7.0$ ,  $SD = 2.3$ ), High Risk Locations Tool ( $M = 6.0$ ,  $SD = 2.1$ ), Feedback Tool ( $M = 4.0$ ,  $SD = 1.6$ ), Supportive Persons Tool ( $M = 3.1$ ,  $SD = 1.4$ ), Pleasurable Activities Tool ( $M = 2.9$ ,  $SD = 1.7$ ) and Problem Management Tool ( $M = 2.9$ ,  $SD = 1.3$ ). We also were very interested in how participants would use the tools over the course of the 6-week trial. As can be seen in Figure 3, participant usage was high during the first week with a mean level of 28 tool launchings, but diminished until week 4 at which point average tool usage leveled off to approximately 5 tool initiations per week. We also conducted correlational analyses to determine if tool and step usage was related to changes in heavy drinking from the pre-test to the 6-week LBMI-A trial. Results indicated that change in percent of heavy drinking days was associated with overall tool usage, measured by a summation of all tool launchings ( $r = .39$ ,  $P < .05$ ), but not the number of times the steps were viewed ( $r = .18$ , *n.s.*). Further mediation analyses were not undertaken due to the small sample size.

### Participant Comments

When responding to interviewer questions, numerous participants (84%) indicated that the features provided them with enhanced awareness, i.e., “it helped me to keep track” and “the reports made me realize how much I was drinking and what were my triggers”. Participants reported that the main barrier to use was the device we provided. Sixty one percent of participants indicated that indicated that they would have used the system more often if it were on their own phone or another type of phone (“This should be on an iPhone®.” “It is too slow and it bothered me to wait.” “Since it wasn’t on my personal phone, I tended to leave it at home.”). Some participants (49%) also reported difficulty with the high risk location tool, indicating that “it sometimes went off in the wrong place” and “it seemed to work sometimes and not others”.

## DISCUSSION

This project focused on determining the usability and early-stage outcomes of a recently developed, smartphone-based, stand-alone intervention system for alcohol dependence, the LBMI-A. Results from the alcohol outcomes of the pilot study were favorable with large effect sizes for change in percentage of heavy drinking days and drinks per day, as well as a medium effect size for change in drinks per drinking day. There was also some indication that overall usage of the LBMI-A tools was related to reduction in heavy drinking days at the correlational level. These results are notable given that participants in the study were drinking heavily and met proposed DSM V criteria for an alcohol use disorder. Most studies that document effects from technology-focused alcohol interventions have been undertaken with at-risk and problem drinkers [8, 9, 11, 28] who likely did not have the same level of alcohol dependence as participants in this study. These studies also had longer follow-up assessments than what were utilized in the current study, making it difficult to draw direct comparisons between the outcomes of this study and other technology-based interventions.

However, it is notable that the effects of a web-based intervention that shared a few similar features as the LBMI-A (but obviously lacked portability) was found to reduce frequency and quantity of drinking by approximately 50% [29] and that a 12-week, text-messaging based intervention system that focused on drinking assessment, goal setting and recommendations for maintaining limits reduced heavy drinking days by about 60% at a 3-month follow-up [30], which are similar to the effects found in this study. It is encouraging that the LBMI-A pre-post gains were in a similar magnitude range as those found in other technologically-based interventions in a sample that arguably had longer, more intensive drinking histories than those used in prior studies.

Findings from the current study must be considered preliminary as our measure of effectiveness was from baseline to the 6-week period during which participants used the system. Long-term follow-up data would be instrumental in determining the endurance of improvements as well as enabling comparisons with improvements from other technologically-based treatments. Participants were also compensated for their involvement in the study, which adds another level of uncertainty regarding how comparable these outcome data would be to those garnered from studies examining more naturalistic use.

Another central area of focus in the current study was ease of use of the LBMI-A features. This was a primary concern as research suggests that individuals with an alcohol use disorder and those early in treatment often experience decreased executive functioning including difficulty with novel tasks, planning and working memory [31]. During the development cycle, we put extra effort into making the system easily navigable with simplified language and a straight forward, step-wise progression through the modules, which appears to have been effective as evidenced by moderately high ratings on ease of use of most aspects of the system.

The LBMI-A system provided brief, psychoeducational modules called Buddy Steps. Results suggested that information within the Buddy Steps was rated as helpful by participants in changing their drinking. Information pertaining to commonly experienced difficulties among individuals in treatment for an alcohol use disorder such as craving and finding non-drinking pastimes were rated as being particularly helpful. This is important information about system usability as we could only speculate about users interest in reading somewhat lengthy information that was provided in the steps. Usage data also suggested that participants visited each step on multiple occasions (twice, on average). A few participants even indicated that viewing the information contained in the steps was their favorite part of using the system. Given our pattern of results, it is likely that psychoeducational information that is obviously related to problems encountered when changing problematic drinking (i.e., information about craving for individuals with a long history of heavy drinking) is more likely to be viewed compared with information that could be viewed by users as being tangential to their goals (i.e., improving communication skills). These results, while useful in identifying features that users rated positively, need to be interpreted cautiously as the rating scale was not empirically developed and we have no information about its reliability. Future research should include a psychometrically validated instrument to address user-defined helpfulness.



Participants also rated the in-the-moment tools for managing alcohol-related problems as being helpful in changing their drinking. They rated the tools related to managing cravings and keeping track of their alcohol use the highest. Numerous participants voiced that it was helpful to have immediate access to strategies such as urge surfing when experiencing a craving. It was somewhat surprising to find that the Daily Interview was the most highly rated tool. Participants frequently indicated that recording their drinking on a daily basis helped build awareness of the extent to which they were drinking. It is interesting to note that while the High Risk Location Tool was not rated as particularly helpful, the High Risk Locations Step was the most highly viewed among all the steps as recorded by the LBMI-A system. This coincides with some participants report that monitoring for and receiving alerts when in a high risk location was an intriguing feature and potentially very useful, but due to unreliable system functioning around their high risk locations, it was not deemed to be useful in this study. This feature thus has potential in future versions, but it requires the right combination of hardware and software. The most recent smartphones have substantially improved location services over the device we utilized (a 2009-era smartphone) and could be programmed to be much more reliable.

Results of the current study carry meaningful implications for system improvement that could be helpful for others interested in developing smartphone-based interventions for substance use disorders. Given participant feedback, several key areas were identified for optimal usability. First, *personalization*: availability of system on individual's personal phones will very likely enhance utilization of strategies and tools. We provided participants with an LBMI-A enabled phone to use for the duration of the study. Participants reported to research staff that they frequently left the device at home due to concerns about damaging it or the hindrance of carrying both the LBMI-A phone and their personal phone, which obviously limited its utility as a mobile intervention system. The non-personalization of the LBMI-A system in the current study proved a primary limitation to understanding more precisely how people would use this type of system to facilitate behavior change naturalistically. Second, *user engagement* with the system is vital, particularly as overall system usage in this study was shown to be related to changes in heavy drinking. Participants' use of the current system dropped off after it stopped prompting them to visit new psychoeducation modules and try new tools (after the second week) to around 5 tool presses per week. Users should not be expected to interact with intervention and monitoring systems completely independently, without notifications or alerts. If a developer deems a particular function to be instrumental in facilitating behavior change, it will likely be utilized more heavily if actively delivered (by prompting the user, for instance). Third, *reduce invasiveness and enhance privacy*: disguising alerts around high risk times and high risk locations for drinking as ordinary phone sounds (rather than strange-sounding alarms) may decrease barriers associated with their use. Numerous participants in this study noted that unusual or loud, app-specific alerts and notifications on their screen was a barrier for system use, especially when around others. Fourth, *include all modules and interactivity on the device*: with few exceptions, participants did not visit the web-based LBMI-A Communications step, indicating the low utility of non-phone-based modules. It appears that mobile intervention systems will be utilized more heavily when all functionality is located on the mobile device. For instance, the LBMI-A Supportive Persons tool required delegated

support persons to go to a separate web site to accept their role, which some participants indicated was problematic for their elected supportive persons and sometimes resulted in poor following through. Lastly, *maximize the quality of user interface*: all system functions must be user-friendly, straightforward, and easy to navigate. Systems designed for managing substance use problems need to function at least as well as other smartphone apps in order for individuals to truly engage with them.

Continued development and application of mobile intervention technology for problematic alcohol and other substance use is vital due to the potential to reach many individuals who would not otherwise receive help. Results from the current study suggest that systems such as the LBMI-A have potential to provide interventions that are cost effective and immediately available, attributes that are unique in the current substance abuse treatment context. There are, however, major challenges to their successful implementation. Future efforts need to focus not only on developing mobile intervention apps that users find helpful, intuitive and engaging, but to also undertake the necessary research to demonstrate their immediate and long-term effectiveness.

## Acknowledgments

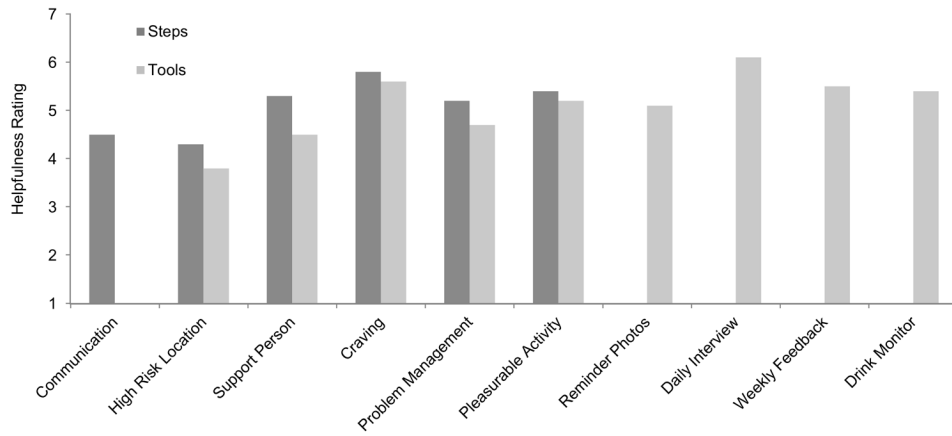
This project was funded by the National Institute of Alcohol Abuse and Alcoholism (NIAAA), Grant # RC2 AA019422-02

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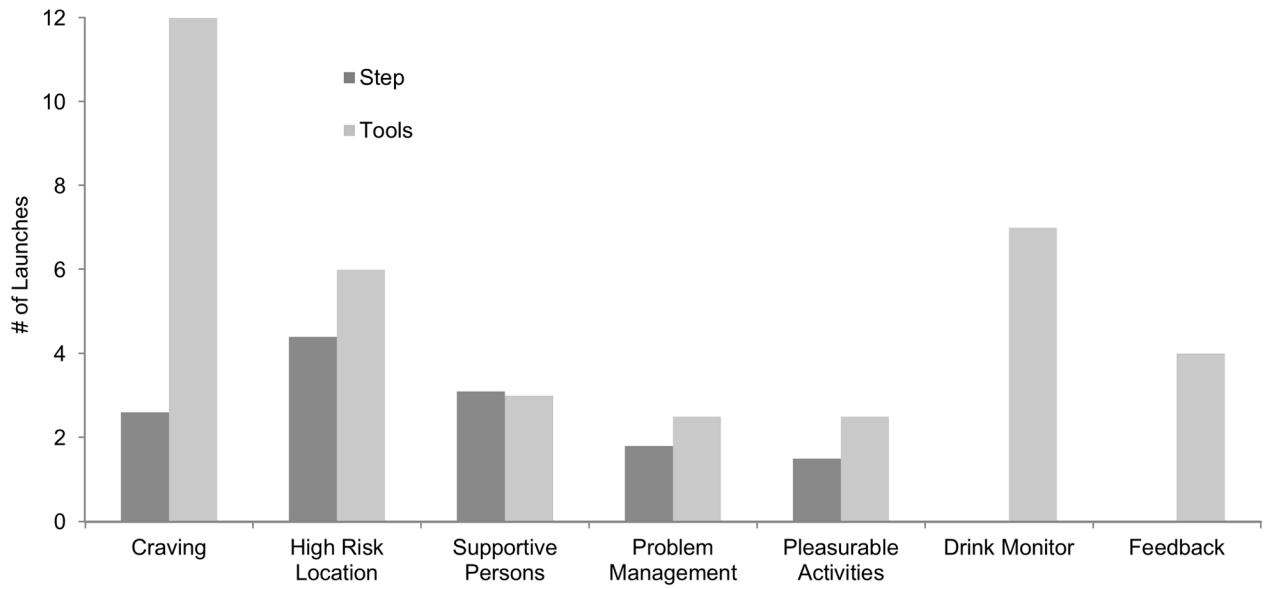
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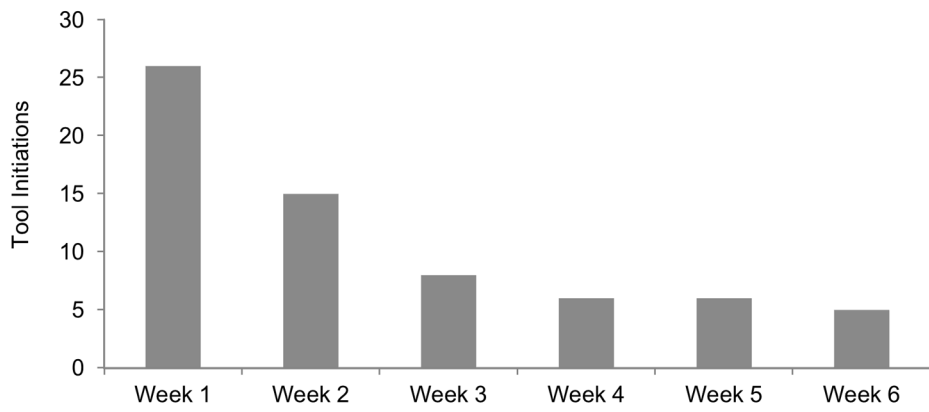
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**Figure 1.** Reported helpfulness of the LBMI steps and tools. Figure 2. Mean number of times participants launched LBMI-A steps and tools.



**Figure 2.**  
Mean number of times participants launched LBMI-A steps and tools.



**Figure 3.** Mean LBMI-A tool usage per week over the 6-week trial.

**Table 1**

LBMI-A steps and tools.

Step content	Tools and functionality associated with the step
<p><b>Step 1. Assessment and Feedback</b></p> <ul style="list-style-type: none"> <li>Brief motivational intervention comprised of assessment of drinking-related behavior and consequences</li> <li>Personal feedback report</li> <li>Decisional balance and reasons for change</li> </ul>	<p><b>Feedback Reports</b></p> <ul style="list-style-type: none"> <li>Initial feedback report</li> <li>Weekly reports of progress (e.g., change in drinking, cravings associated with drinking, ways to avoid continued drinking)</li> </ul> <p><b>Drink Monitor Tool</b></p> <ul style="list-style-type: none"> <li>User records drinking in vivo</li> </ul> <p><b>Day After Interview</b></p> <ul style="list-style-type: none"> <li>Daily interview of drinking and cravings experienced the prior day</li> </ul>
<ul style="list-style-type: none"> <li><b>Step 2. High-Risk Locations (HRL)</b></li> <li>Rational for avoiding high risk locations for drinking and how Buddy aids in this</li> <li>Advice to remove alcohol and alcohol-related cues from the home</li> <li>Selection and identification of HRL's</li> </ul>	<p><b>High-Risk Locations Tool</b></p> <ul style="list-style-type: none"> <li>When a boundary is crossed - HRL alert (audible and vibration)</li> <li>Menu of coping strategies (e.g., leaving, drink refusal skills, contact a support person, find an AA meeting)</li> </ul>
<p><b>Step 3. Supportive Person (SP)</b></p> <ul style="list-style-type: none"> <li>Psychoeducation on the benefits and use of SPs while changing problematic drinking</li> <li>Orientation to how SPs could be used in Buddy at the user's discretion (e.g., contacting the SP when in a high-risk situation for drinking)</li> <li>Qualities of a good SP</li> </ul>	<p><b>Get Support Tool</b></p> <ul style="list-style-type: none"> <li>User identifies potential SP's</li> <li>SP selection procedure</li> <li>SP is sent instructions on how to help a person with an alcohol problem</li> </ul>
<p><b>Step 4: Cravings</b></p> <ul style="list-style-type: none"> <li>Psychoeducation on cravings</li> <li>Identification of common triggers</li> <li>Strategies for avoiding triggers and managing cravings</li> </ul>	<p><b>Craving Tool</b></p> <ul style="list-style-type: none"> <li>User records strength and type of craving</li> <li>Provided menu of strategies for managing craving (e.g., urge surfing, contact SP, viewing reasons for change)</li> </ul> <p><b>Reminder Photos</b></p> <ul style="list-style-type: none"> <li>User can add photos of that remind them of their reasons for change which are accessible at any time and within other tools (e.g., cravings, HRL)</li> </ul>
<p><b>Step 5: Problem Management</b></p> <ul style="list-style-type: none"> <li>Psychoeducation on the association of life problems and maladaptive responses</li> <li>Problem solving skills training</li> </ul>	<p><b>Problem Management Tool</b></p> <ul style="list-style-type: none"> <li>User identifies of type of problem (e.g., life problem, anxiety)</li> <li>Instruction on following problem solving steps</li> <li>Instruction for coping with anxiety (e.g., muscle relaxation exercise), boredom, feeling down</li> </ul>



Step content	Tools and functionality associated with the step
<p><b>Step 6: Communications</b></p> <ul style="list-style-type: none"> <li>• Rationale for improving communication skills.</li> <li>• Drink refusal skills</li> <li>• URL for Buddy website to review the rest of the module</li> </ul>	<p><b>Communications Web-site</b></p> <ul style="list-style-type: none"> <li>• Psychoeducation on positive communication.</li> <li>• Interactive module on using assertive communication</li> </ul>
<p><b>Step 7: Pleasurable Activities</b></p> <ul style="list-style-type: none"> <li>• Psychoeducation on how problem drinking and its cessation can result in life changes to how and with whom time to spend time</li> <li>• Description of Pleasurable Activities Tool</li> </ul>	<p><b>Pleasurable Activities Tool</b></p> <ul style="list-style-type: none"> <li>• User selects from a pleasant activity schedule to generate a personalized list which can be modified at any time</li> </ul> <p><b>Schedule Activities Tool</b></p> <ul style="list-style-type: none"> <li>• User schedules activities into a calendar</li> </ul>