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The alcohol tracker application: an initial evaluation of user preferences

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ABSTRACT

Background The prevalence of at-risk drinking and alcohol use disorders is increasing. Advances in technology have resulted in numerous smartphone applications for this disorder. However, there are still concerns about the evidence base of previously developed alcohol applications.

Objective The following study aims to illustrate how the authors have made use of innovative methodologies to overcome the issues relating to the accuracy of tracking the amount of alcohol one has consumed; it also aims to determine user perceptions about the innovative tracker and various other features of an alcohol self-management application among a group of individuals from the general population of a developed country (Canada).

Methodology A native alcohol self-management application was developed. In order to determine user perspectives towards this new innovative application, the authors took advantage and made use of crowdsourcing to acquire user perspectives.

Results Our results showed that smartphone ownership is highest among the age group of 35–44 years (91%) and lowest for those aged between 55 and 64 (58%). Our analysis also showed that 25–34-year-olds and 35–44-year-olds drink more frequently than the other groups. Results suggest that notification and information were the two most useful functions, with psychotherapy expected to be the least useful. Females indicated that notification service was the most useful function, while males preferred the information component.

Conclusions This study has demonstrated how the authors have made use of innovative technologies to overcome the existing concerns pertaining to the utilisation of the blood alcohol concentration levels as a tracker. In addition, the authors have managed to highlight user preferences with regard to an alcohol application.

INTRODUCTION

The WHO, in its report on the global status on alcohol and health, has clearly highlighted that alcohol use disorders are a major worldwide problem that has resulted in millions of deaths each year.[1] Of particular concern, it should also be noted that the highest alcohol consumption rates are usually found in the developed world, including most parts of Western and Eastern Europe. In addition, higher income countries generally also have the highest alcohol rates.[1] Typically hazardous levels of drinking for males would be drinking more than 40 g/day alcohol on average (which is around 5 units) and for females, drinking more than 24 g/day (which is around 3 units).[2] Hazardous drinking habits have been linked with increased incidences of liver disease, hypertension and violent deaths for males; and for females, increased incidences of developing liver diseases and breast cancer.[2] In Canada, a recent study looking at data obtained from the Centre for Addiction and Mental Health in Ontario between the period of January 2005 and December 2010, and involving a cumulative sample size of 13 557 individuals, has noted that the prevalence of alcohol usage and risky drinking was much lower in foreign-born as compared to Canadian-born individuals.[3] Ethnicity was noted to be a mediating factor affecting whether individuals were at-risk heavy drinkers.[3] In its report, the WHO has clearly stated that governmental organisations now have increased recognition of the gravity of alcohol-use disorders and its complications and have instituted various measures to help cope with the increasing prevalence and mortality arising from risky usage of alcohol.[1]

In the past decade, there have been major advances in Internet and Smartphone-based

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technologies that have had an impact on medicine and patient care. There are existing published papers on the utilisation of smartphone technologies for chronic disease management,[4] patient monitoring,[5] rehabilitation[6] and medical diagnosis,[7] as well as for outreach efforts in developing countries.[8] Such advances in Internet and Smartphone-based technologies have also been utilised to help individuals with alcohol use disorders. Examples of such interventions include the usage of text messages as a mechanism of behavioural support for youths who are at risk of hazardous drinking.[9] Previous evaluations have identified that such a text-message based intervention has produced small reductions in self-reported binge drinking and the number of drinks consumed per drinking day.[9] Other interventions, such as the Location-Based Monitoring and Intervention for Alcohol use Disorder (LBMI-A)[10] include features such as interventions for on-going drinking, cravings, social connections, management of life problems, high-risk location alerting and activity scheduling. These features have demonstrated clinical efficacy as there have been significant reductions in the amount of hazardous alcohol use after an intervention,[10] with the intervention largely catered for individuals diagnosed with alcohol-use disorder. The drink monitor toolkit featured in LBMI-A allows the users to press a button within the application when they are drinking, hence enabling measurement of drinking in vivo. Other research has also demonstrated the clinical efficacy of a smartphone application to help support recovery from alcoholism.[11]

A search through the existing published applications on both the Apple IOS and the Android Play store, using the keyword 'Alcohol', yielded a total of 1378 applications on the Apple IOS store alone. Prior research[12] shows a content analysis of 500 smartphone applications made available on the store and have highlighted that the vast majority of applications (50%) are not clinical-based, and largely for entertainment purposes. An estimated 39% of the applications are blood alcohol concentration (BAC) applications, and only 11% of the applications were noted to be health promotion or stop drinking applications.[12] One of the issues highlighted by the previous review and analysis was that the vast majority of applications appeared to help promote drinking and even though there were applications estimating BAC, they were highly unreliable. Of particular concern was that applications also gave a specific time to which users could return to their normal activities, such as drinking.[12] One of the recommendations based on the review includes the recommendation that health professionals need to get more involved and help to regulate and review the evidence base of existing published applications. A recent review looking into the behaviour change techniques in popular alcohol reduction apps has highlighted that the vast majority of apps still implicitly or explicitly promoted the usage of alcohol.[13] Again, issues with regard to the evidence base of the app were raised. Taking this into consideration, the following study aims to illustrate how the authors have made use of innovative methodologies to overcome the issues relating to the accuracy of tracking the amount of alcohol one has consumed by means of an innovative smartphone application; and the following study also aims to determine user perceptions about the innovative tracker and various other features of an alcohol self-management application among a group of individuals from the general population of a developed country (Canada). The difference between the current innovation and the innovations previously reviewed in the existing literature is that the current innovation serves to target at-risk drinkers, and less so, those who are diagnosed with alcohol-use disorders, or those who have a history of alcohol-use disorders and are in remission.

METHODOLOGY

The alcohol self-management application

The first author, MWBZ, in consultation with the last author, RCMH, formulated the initial scope of the application and delineated the contents to be included prior to the actual development of the smartphone application. The development of the application has been previously described by Zhang *et al*[14] in their video commentary to BMJ Innovations.

The following contents were included as they were deemed to be helpful for those who are at-risk drinkers and for those who are abusing or are dependent on alcohol.

A. Unique alcohol tracker that enables individuals to log down the absolute number of beers, wine and shots they have taken on a daily basis; this in turn would be translated into units of alcohol and stored in the smartphone application
B. Unique imediate notification if users have exceeded the limit for the day/or their limit for the week (The notifications are pre-programmed based on the recommended number of units for males and females in accordance with the National Institute for Health and Care Excellence (NICE) (UK) and the Canadian Guidelines.)
C. Calendar view of the total number of units of alcohol consumed on a weekly basis
D. Immediate links to a hotline for those who wish to seek help for their alcohol issues
E. Information about signs and symptoms of alcohol abuse and dependence
F. Information about the medical complications that might arise from both short-term and long-term alcohol usage
G. Psychological therapies, which included that of a functional analysis chart as well as a behavioural goals chart
H. Integration of an Alcohol Use Disorders Identification Test (AUDIT) questionnaire for self-monitoring and diagnosis.

Following the formulation of the scope of the application as well as defining the contents of the application, the development of the android version of the application was undertaken by the first author,

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MWBZ, in consultation with a mobile application software company. Android Java developmental kit (ADK) was utilised to programme the core features of the application. MySQL programming language was utilised to programme the core features of the server to gather the survey results of the AUDIT questionnaire. The entire developmental phase took approximately 6 weeks to complete, with 2 weeks of testing prior to deployment onto the android play store. The application was made available on the android play store since 4 February 2015.

In order to determine user perspectives towards this new innovative application, the authors took advantage and made use of crowdsourcing to acquire user perspectives. Crowdsourcing is a method in which online users could help to perform specific tasks in exchange for a nominal fee. A total of 100 Canadians aged between 18 and 75 years were recruited online by means of the crowdsourcing website. All participants were paid US $0.10 for their participation in the evaluation and the subsequent 10 min survey. All the participants had to consent to the terms and conditions on the crowdsourcing website prior to their participation in the study. In order to ensure the reliability of the participants, the approval rating for the participants was set at 90%, which meant that they had had past experiences and were validated to help out in another survey. A minimum time of 200 s was set for each questionnaire, and participants needed to spend a minimum of 200 s to fill up the survey. This was to ensure that participants did not fill up the questionnaire at random. A demographic survey was crafted, along with a user perspective survey, which asked questions largely pertaining to the user's perception of the individual features of the application. Participants were to rate their perception on a five-point Likert rating scale. The survey was disseminated via the crowdsourcing website and participants were allowed 2 weeks for the completion of the survey.

As this was an application developed and launched internationally, the authors MWBZ and RCMH worked with collaborators from Shandong University and the University of British Columbia, Vancouver BC. The Institutional Review Board of the Department of Medicine, Shandong University, People's Republic of China approved of this international collaborative research.

All statistical analyses were performed using the SPSS statistical program V.18.0 for Windows. Categorical variables were expressed by number (N) and percentage (%). Continuous variables were expressed as mean and SD. Further analysis of the data-set were conducted using T-test. Statistical significance was set at $p<0.05$ for all analyses.

RESULTS

Demographic information

A cumulative total of 100 Canadians took part in the user perception survey. 40% were male, and 58% were female, with 2% preferring not to disclose their gender. The vast majority of individuals was from Ontario (58%) and within the age range of 25–54. 72% were Caucasian in ethnicity, and the vast majority were educated with a Bachelor's degree. Most of our participants were married (58%) and 83% indicated that they owned a smartphone, with 45% using the android platform and 29% using the apple platform. Further analysis also showed that nearly 55% of males were android phone users, whereas only 38% of females were android users. Most of the females were apple users instead. Table 1 shows the basic demographic information of our participants.

Smartphone ownership

Further analysis also showed that smartphone ownership was highest among the age group of 35–44 years (91%) and lowest among those aged between 55 and 64 (58%). In addition, the analysis also showed that education attainment was correlated with smartphone ownership. Table 2 shows the percentage of smartphone ownership according to age and educational status.

Alcohol consumption and smartphone ownership

With regard to alcohol consumption, individuals have been classified into three categories: Heavy frequency consumption (which includes daily drinking, 2–3 times per week or once per week), infrequent consumption (which includes drinking every 2 weeks, every month and social drinking) and never drinking. Our analysis showed that 66% of the individuals have self-reported heavy consumption, while 25% are infrequent drinkers and 9% have never drunk. Of importance, by considering the average frequency of consumption using a six-point scale to represent responses (daily drinking=6, drinking every 2 weeks=3, never=0), males (mean of 3.85) drink more frequently than females (mean of 2.93). The effect size between males and females is moderate (d=0.57). Our analysis also showed that 25–34-year-olds and 35–44-year-olds drink more frequently than the other groups, with an effect size of d=0.84 for those aged 25–34-years and d=0.81 for those between 35 and 44 years. Further analysis showed that 29% of males aged 18–24 were heavy drinkers with an iPhone or (as another example) 75% of all males aged 35–44 were heavy drinkers with an Android phone.

Perceptions of application

The user perception survey asked participants to rate multiple dimensions of the application using a five-point Likert scale. The mean survey scores for each dimension are presented in table 3. The six dimensions have good internal consistency—with a Cronbach's α of 0.95.

Results suggest that notification and information were the two most useful functions, with

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Table 1 Basic demographic characteristics of participants

Province	% Response (% of total population in 2013)
Ontario	58 (39)
Quebec	14 (23)
British Columbia	10 (13)
Nova Scotia	5 (3)
New Brunswick	4 (2)
Alberta	3 (11)
Manitoba	2 (4)
Newfoundland and Labrador	1 (2)
Unknown	3 (–)
Age Range	**Proportion (%)**
18–24	16
25–34	28
35–44	21
45–54	20
55–64	12
65–74	3
Ethnicity	**Proportion (%)**
White	72
Asian	20
Hispanic	2
American Indian	2
Other	2
Prefer not to answer	2
Education	**Proportion (%)**
Some high school, no diploma	4
High school/HED	19
Some college, no degree	18
Technical/trade/vocational training	8
Associate degree	9
Bachelor's degree	27
Master's degree	13
Professional degree	1
Doctoral degree	1
Marital Status	**Proportion (%)**
Single, never married	34
Married or domestic partnership	58
Widowed	3
Divorced	4
Separated	1

HED, Higher Education Diploma.

Table 2 Percentage of smartphone ownership according to age and educational status

Dimension	Owns smartphone (%)
18–24	87.5
25–34	89.3
35–44	90.5
45–54	80.0
55–64	58.3
65–74	66.7
Some high school, no diploma	75.0
High school/HED	89.5
Some college, no degree	66.7
Technical/trade/vocational training	87.5
Associate degree	77.8
Bachelor's degree	88.9
Master's degree	92.3
Professional degree	0
Doctorate degree	100

psychotherapy expected to be the least useful. Perception appears to depend on gender, with females slightly more positive about the app (and its individual functions) than males, as illustrated in table 4. Females reported a higher mean score than males on every domain, but the difference was not significant. The only domain where there appeared to be a large difference in perception was the alcohol tracker (d=0.4, p=0.06), which suggests that females may be more likely than males to use such a functionality. Females indicated that notification service was the most useful function, while males preferred the information component. In addition, the results in table 5 indicated that the app was rated most useful overall by those in the youngest age group (18–24), and least useful overall by those aged 45–54. The notification service was the highest rated function for those aged 18–44, while for older groups information was rated as the most useful function.

DISCUSSION

On the basis of our current knowledge, this is perhaps one of the first few studies to describe the methodology of developing a new alcohol intervention application and one of the first few studies to evaluate a new methodology of tracking alcohol consumption. The current study was methodologically feasible and the initial users' perspectives demonstrated the usefulness of certain components of the current smartphone application. The vast majority of our sampled users was female and had at least a Bachelor's degree. Of significance, our results showed that the smartphone ownership rates were highest among the 35–44 years age group, and correspondingly lower in the 55–64 years age group. This finding is not surprising, given that other studies have clearly identified that smartphone utilisation is highest among the younger population. In our sampled population, 66% of the users reported heavy consumption of alcohol (daily drinking), and the incidence of drinking was also highest among the younger as compared to the older age group. Interestingly, our results showed that 75% of males aged between 35 and 44 years were heavy drinkers and owned only an Android phone. This in itself

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Table 3 App perceptions

	Users Mean score (SD)
How useful is the alcohol tracker?	1.67 (1.14)
How useful are the provided psychological therapies?	1.57 (1.12)
How useful is the information on alcohol dependence?	1.83 (1.21)
How useful is the notification service?	1.74 (1.24)
How useful is the audit questionnaire?	1.61 (1.22)
Overall, how useful is the app?	1.78 (1.21)

Usefulness rating scale: 4=extremely; 3=very; 2=moderately; 1=slightly; 0=not at all.

would have downstream implications for application design and deployment. Pertaining to users' perception of the features within the application, the results we have obtained suggested that notification services and information were perceived to be the most useful functionality, while psychotherapy was correspondingly being perceived to be least useful. There appears to be a gender difference in users' preference as well, with females tending to prefer the notification services, whereas males tend to prefer the information service. Age is another mediating factor affecting the perception of the usefulness of notification services versus informational content.

Previous research has highlighted the limitations with regard to the BAC methodology of tracking and notifying users with regard to the drinking habits.[15] Among 28 574 students sampled, it was noted that such computation did not have an effect on the absolute amount of alcohol consumption and that it might even lead to more alcohol consumption in certain genders, such as the male gender.[15] Prior evaluation of existing applications, which included that of 'Promillekoll' and 'Party Planner', has highlighted that in order for applications to be more effective, applications need to enable users to be able to manipulate how they track their own alcohol consumption, as well as integrate features that would appeal to both genders.[15] This might be one of the reasons why our currently sampled population perceived the

Table 4 App perceptions in accordance with gender

	Females Mean score (SD)	Males Mean score (SD)
How useful is the alcohol tracker?	1.86 (1.12)	1.40 (1.22)
How useful are the provided psychological therapies?	1.69 (1.16)	1.43 (1.22)
How useful is the information on alcohol dependence?	1.83 (1.17)	1.65 (1.23)
How useful is the notification service?	1.97 (1.31)	1.63 (1.15)
How useful is the audit questionnaire?	1.62 (1.14)	1.55 (1.30)
Overall, how useful is the app?	1.84 (1.15)	1.63 (1.29)

Usefulness rating scale: 4=extremely; 3=very; 2=moderately; 1=slightly; 0=not at all.

Table 5 App perceptions in accordance with age group

	18–24	25–34	35–44	45–54	55–64	65–74
Tracker	1.63	1.68	1.57	1.65	1.75	2.33
Psychotherapy	1.50	1.32	1.81	1.75	1.50	2.00
Information	1.50	1.68	1.90	1.80	1.92	2.33
Notification	1.75	1.93	1.95	1.60	1.75	2.00
Audit	1.25	1.68	1.81	1.50	1.33	2.67
Overall	1.94	1.68	1.90	1.55	1.67	2.00

notification service to be useful, especially so for at-risk female drinkers. In our current application, we have enabled users to log down the amount of beer, wine and spirits that they have drunk on a daily basis. The smartphone application is able to automatically compute and convert the amount they have drunk into relevant alcoholic units. Notifications would be displayed if they have exceeded their daily limits, namely 14 units for females and 21 units for males. In addition, the notification service and the innovative tracker might be perceived to be useful as it enables real-time tracking of relative consumption. Previous studies looked at in-vivo as well as retrospective reports and highlighted that, unlike in-vivo recording, retrospective recording tends to have limitations, as in, it is very likely to result in underestimation of the actual amount of alcohol which has been consumed.[16]

Our current findings are also in line and congruent with the findings of other previous interventions for alcohol use disorders.[17] Previous interventions have determined that individuals tend to find the following features most useful in a phone, which are that of provision of awareness as well as tracking and prompts.[17]

The strength of this study is that we managed to make use of existing technological advances to develop a self-help alcohol smartphone application that could circumvent the previous issues pertaining to the concerns of using BAC levels as a tracker. We have managed to evaluate the prototype that we have developed in a group of at-risk and heavy drinkers and have identified their user preferences. Of interest, we managed to also identify the differences between the genders with regard to their perceptions of the usefulness of individual components of the applications. This would be informative and would affect how future applications might be developed.

The limitations in this study include the fact that our sample size is limited to a total size of 100 individuals. Preferences might differ if the sample size was larger. In addition, the educational level of our participants tends to be higher as compared to that of a normal population. Also, the authors have developed only an English version of the application and this limits the further evaluation of the application. In addition, the authors have not included within the application more comprehensive psychological interventions and this might have affected user perceptions.

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CONCLUSIONS

This study has demonstrated how the authors have made use of innovative technologies to overcome the existing concern pertaining to the utilisation of the BAC levels as a tracker. In addition, the authors have managed to evaluate the applications in a sample group and have highlighted user preferences that should be considered when future applications for alcohol use disorders are being formulated and developed.

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Competing interests None declared.

Ethics approval Shandong University, China (on behalf of the international consortium): LL-201501062.

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