User Centred Test of "BreindeBaas": How do individuals with MBID perceive the app?

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Abstract

Alcohol use can cause problems for individuals. For individuals with MBID alcohol (ab)use is problematic because of health risks and the lack of effective treatments for this group. In this study a smartphone application based on Cognitive Bias Modification is tested by individuals with MBID. Training and measurement sessions use an adapted version of the Approach-Avoidance Task. The Approach-Avoidance Task changes cognitive biases by pushing alcoholic beverages away and pulling non-alcoholic beverages. Also, the application allows users to personalize sessions with pictorial stimuli of their choice. Moreover, the app has features such as reminders, a dairy function and motivational messages. This study aims to gain insight in the acceptability and usability of the application for individuals with MBID and to pilot test the cognitive bias measure in this app for individuals with MBID.

The app is tested with nine individuals with MBID, that are abstinent or considered light drinkers. Participants are aged between nineteen and fifty. The participants of this study completed a baseline questionnaire, pre-test bias measurement, post-test bias measurement, and exit interview. The baseline questionnaire measures baseline characteristics, alcohol use and smartphone usage. The exit interview aims to measure user experience and acceptance of the app for users with MBID. Participants are asked to follow a seven-day training schedule of one CBM-AAT training session a day. Moreover, the log-data of the application is used to gain additional insight in adherence to the training schedule.

During interviews participants indicated the downloading and installation of the app was straightforward. Participants are positive about the usability of different features of the app, but also suggests some points of improvement. Overall, participants do not comprehend the working mechanism and purpose of the app. Generally, training sessions are described as unobtrusive to their daily life. Training sessions are completed predominantly at home, during a time of the day fitting to the schedule of the participants. Adherence to the training schedule is sufficient. The assessment of cognitive bias revealed high reaction times in the test group.

Overall, the BdB-app is considered to be acceptable and usable for users with MBID, although some improvements would increase the acceptability and usability for individuals with MBID. To increase usability of the BdB-app for users with MBID it is important for designers to implement changes suggested in this study, in addition to involve this user group in the design process. Moreover, to increase acceptability of the BdB-app a thorough implementation plan aimed at context of training sessions, performance expectancy and training schedule is needed. Unfortunately, based on the data of the current study, no inferences can be made on the psychometric quality of the bias measurements. Thus, more research is advised.

Contents

1. Introduction

Going to a party and drinking some alcohol or an expensive wine with a multicourse dinner are things we consider to be normal in our everyday lives. This illustrates alcohol is a widely used and prevalent substance (World Health Organization, 2020). In 2016/2017 about 76% of the Dutch population of twelve years and older were said to be drinking alcohol (Centraal Bureau Statistiek, 2020). Alcohol consumption in The Netherlands is estimated to be 8.7 litres of pure alcohol per person per year over the age of fifteen (World Health Organization, 2018). Drinking too much alcohol can lead to various serious health concerns, such as brain damage or damage to the cardiovascular system (World Health Organization, 2020). Moreover, drinking on a regular basis can lead to a dependence on alcohol. In the DSM-V, the collective term Alcohol Use Disorder (AUD) is used to describe all alcohol related illnesses, and is classified in three levels: mild, moderate and severe (National Institute on Alcohol Abuse and Alcoholism, 2020).

Whereas the aforementioned is true for the general population, there are differences for individuals with Mild to Borderline Intellectual Disabilities (MBID) (IQ 50 -85). Individuals with MBID are more at risk for the negative consequences of drinking alcohol (Degenhardt, 2000; Slayter, 2010). For instance, individuals with MBID are more at risk of developing an AUD (Degenhardt, 2000; McGillicuddy, 2006). Additionally, reducing drinking habits can be more challenging for individuals with MBID when compared to individuals with an average IQ, because of more limited access to healthcare and addiction treatment (van Duijvenbode, Didden, Voogd, Korzilius, & Engels, 2012). VanDerNagel et al., (2017) estimated 64% of the Dutch adults (18≥) with MBID use alcohol currently, and reported 93.8% used alcohol once or more in their life time. In their exploratory study Bransen et al., (2009) found a life time use of 76% among young (12-25) individuals with MBID. Exact numbers on alcohol (ab)use in individuals with MBID are scarce worldwide. Factors that could contribute to this scarcity are: rules and regulations surrounding alcohol in different countries (Carroll Chapman & Wu, 2012), a tendency to give socially desirable answers when asked directly about their alcohol usage (McGillicuddy, 2006), combinations of different levels of intellectual disabilities into one group which makes data ambiguous (Emerson & Turnbull, 2005), and, sparse availability for validated and adapted measures for this group (van Duijvenbode et al., 2015).

1.1 Cognitive Bias & Cognitive Bias Modification

A wide range of AUD treatments are available, ranging from pharmacological treatments to behavioural/psychological treatments (Witkiewitz, Litten, & Leggio, 2019). In the past few years Cognitive Bias Modification (CBM) is proposed as a possible treatment for individuals in the general public with AUD (Eberl et al., 2013; Stacy & Wiers, 2010). CBM is aimed at reducing cognitive biases towards alcohol (Wiers, Gladwin, Hofmann, Salemink, & Ridderinkhof, 2013). In literature three different cognitive biases are distinguished: memory bias that activates positive evaluative

associations towards alcohol, attentional bias that directs attentions towards stimuli that are associated with alcohol, and approach bias that automatically activates action tendencies to approach alcohol (Gladwin et al., 2011; Stacy & Wiers, 2010; Wiers et al., 2002; Wiers et al., 2009). Cognitive biases are formed because of the rewarding effects of alcohol. Alcohol-related stimuli become overrated and will decrease the value of other rewards (van Duijvenbode, Didden, Korzilius, & Engels, 2017a). Stimuli of which cognitive biases are formed, such as alcohol, seem more attractive, capture more attention, and have greater influence on behaviour compared to other stimuli (Field, Kiernan, Eastwood, & Child, 2008). This influence mostly occurs outside of conscious awareness. Therefore, cognitive biases are part of implicit cognition (Peeters et al., 2012; Stacy & Wiers, 2010; van Duijvenbode et al., 2017a).

As stated before, CMB is aimed at re-training cognitive biases (Wiers et al., 2013), different paradigms of re-training cognitive biases towards alcohol are described in literature. To illustrate: Alcohol Attention-Control Training Program to shift attentional bias (Fadardi & Cox, 2009), Visual Probe Test to modify attentional bias (Christiansen et al., 2015), the Manikin task for re-training approach bias (Field et al., 2008), and the Approach Avoidance Task (AAT) to alter approach bias designed by Wiers et al., (2009). This thesis focuses on the AAT method to modify cognitive biases towards alcohol. When training with the AAT participants are asked to push or pull pictures of drinks towards them or away from them with a joystick. These pictures are of alcoholic or non-alcoholic drinks. Participants are told to focus on the formatting of the picture (e.g. landscape or portrait) (Wiers et al., 2009; Wiers et al., 2010). In the AAT a ‘zoom feature’ is implemented, meaning that when pushing or pulling the picture, it creates the illusion of the stimulus moving away or pulling towards the participant (Wiers et al., 2009).

Studies into the effect of AAT-training on approach bias and alcohol intake seems promising (Eberl et al., 2013; Kakoschke, Kemps, & Tiggemann, 2017). First, studies regarding inpatients and individuals receiving treatment for alcohol abuse are discussed. Wiers et al., (2011) found their brief AAT intervention changed cognitive bias from a small approach bias towards alcohol at pre-test, to a strong avoidance bias at post-test for their experimental group of alcohol patients during regular treatment. In a sample of alcohol dependent patients in treatment by Eberl et al., (2013), found that patients developed a strong avoidance bias towards alcohol at post-test, after completing twelve AAT-training sessions. While the control group did not develop an avoidance bias. In both aforementioned studies significant differences were found in abstinence one year after treatment. During the study by Manning et al., (2016) into alcohol-dependent inpatients, 75% of the training group stayed abstinent after completing four AAT-training sessions, versus 45% of the control group. Additionally, Wiers et al., (2014) observed a small, not significant, decrease of cognitive bias towards alcohol in alcohol depended inpatients. Rinck et al., (2018) noticed a marginal significant decrease in approach bias towards alcohol in their abstinent inpatient AAT-treatment group. However, they observed a decrease of 8.4% in relapse in the one year follow up.

Secondly, there are a number of studies regarding the general population. Wiers and colleagues (2015) found a reduction in bias towards alcohol in all groups, in their study of an online approach bias re-training for the general population. No significant difference in alcohol intake was observed, at follow-up between the treatment or CBM group and the sham training group. In the study by Laurens et al., (2020) among the heavy drinkers in the general public, was a significant reduction of alcohol intake observed, in their follow-up after three months. It should be noted that no bias measurements were conducted and there was no control group. On the contrary, some studies found no effect on cognitive biases or even a light increase in bias towards alcohol after CBM training sessions. For example, Claus et al., (2019), whom found a non-significant increase in bias toward alcohol in heavy drinkers after four AAT-training sessions.

Lastly, five studies towards students are reviewed. Sharbanee et al., (2014) found a small, non-significant, decrease in alcohol intake in students after one AAT training sessions. Which suggests one AAT training session is not enough to change drinking behaviour. Lindgren et al., (2015) conducted two studies among students, in both studies Lindgren and colleagues observed no effect of AAT training on bias scores. Di Lemma & Field, (2017) did not observe a strengthening of avoidance bias after one single training session. Although, they observed a decrease of alcohol intake during a taste test after a single training session. Den Uyl et al., (2016) found no effect on cognitive bias towards alcohol in heavy drinkers, after three sessions. As seen above, past results of AAT-training sessions do not provide a clear picture of its efficacy. Important to note is that results of past studies are hard to compare (see Boffo et al., 2019 and Wiers et al., 2018).

Additionally, AAT is also used for measuring the strength of cognitive biases (Wiers et al., 2010). When measuring bias using AAT, another design is used in comparison to the training sessions. In contrast to the training task, the measurement task consists of two trials. In the first trial the participants approach the stimulus (alcohol) by pulling it towards them, and in the second trial the push-and-pull conditions are reversed; participants push the alcohol away. In other words, users first perform a bias-congruent task (pulling alcohol) and subsequently a bias-incongruent task (avoiding alcohol). The Alcohol-Approach Bias score is calculated by the participants' reaction times (RT). The stronger the cognitive bias, the slower a participant will push the alcoholic beverage away, and the faster one would pull the alcoholic beverage towards them (Wiers et al., 2010). Additional information about the reliability and validity of AAT to measure alcohol approach bias will be discussed in paragraph 1.2.

Application of CBM for individuals with MBID is underexposed in literature. van Duijvenbode, Didden, Voogd, et al., (2012) investigated if cognitive biases are present in individuals with MBID, using the Visual Dot Probe and AAT task. They did not find differences in attentional- and approach bias towards alcohol between individuals with- and without MBID. Therefore, it is likely that studies about cognitive biases in the general population are also applicable to individuals with MBID. van Duijvenbode, Didden, Voogd, et al., (2012) did find a higher bias score in individuals

that drink problematically with MBID in comparison to individuals that drink problematically without MBID in the Visual Dot Probe Task. Moreover, van Duijvenbode et al., (2017a) noticed higher overall RT in individuals with MBID on these tasks, possibly due to deficiencies in executive functioning. Also, individuals with MBID can be described as individuals with weaker executive control (Peeters et al., 2012). van Duijvenbode et al., (2017b) theorize that individuals with weak executive control might be more strongly influenced by cognitive biases than individuals with stronger executive control. Individuals with MBID show lower inhibitory control, which explains why with MBID individuals more often act on impulses (Peeters et al., 2012; van Duijvenbode et al., 2017a). This suggest that individuals with MBID will likely benefit more by an intervention focused on the reduction of their cognitive bias towards alcohol. Aforementioned underlines the need for additional research into CBM for individuals with MBID.

1.2 Brein de Baas

This thesis aims to test a mobile CBM application with individuals with MBID. That mobile CMB application is "BreindeBaas" (BdB). BdB is a smartphone application that aims to reduce cognitive biases via training sessions based on the AAT method. The BdB-app is designed to change cognitive biases toward alcohol with using an adapted version of the AAT (Laurens et al., 2020). In the pilot study of Laurens et al., (2020) the BdB-app was tested with individuals that reported problematic alcohol use. Laurens and colleagues observed a significant decrease of alcohol intake, alcohol intake dropped from 31.6 units at baseline to 18.2 units at three months follow-up. Participants completed four or more training sessions. Moreover, Laurens et al., (2020) studied user experience. Users stated feeling more in control of their alcohol usage, although 47% reported they gained nothing from the app. Additionally, users referred to the app as boring and monotonous and some suggestions were made to increase attractiveness of the app. It is important to keep in mind that the pilot study did not include a control or sham-training group, and it is therefore not possible to fully establish what factors contributed to the reduction in alcohol intake. After the studies of Laurens et al., (2020) and Somsen (2017), a new version of the BdB-app was launched by Tactus addiction care in March 2021. Different features were added to the BdB-app, such as the ability to personalise pictures used for training and a possibility to measure the strength of the users' bias towards alcohol. Participants use the newest version of the BdB app launched in March 2021.

So far, the BdB-app has not been tested for individuals with MBID. van Duijvenbode, Didden, Bloemsaat & Engels (2012) established in their study that individuals with MBID understand how, and are able to complete joystick AAT tasks. This finding evokes curiosity about the possibilities and effects of a CBM intervention for individuals with MBID. Unfortunately, individuals with MBID are often unable to benefit from interventions or other treatments designed to help individuals cope with alcohol (ab)use (van Duijvenbode, Didden, Voogd, et al., 2012), due to poor executive control (e.g.

limited vocabulary, poor development of memory function and difficulties discriminating between irrelevant and relevant information). Existing interventions and treatments lack in efficacy for individuals with MBID (Kiewik, VanDerNagel, Engels, & de Jong, 2017).

Designing interventions that fit the needs of the users helps acceptability of the intervention (Gemert-Pijnen, Kelders, Kip, & Sanderman, 2018). According to the CeHRes-roadmap designing an eHealth intervention is done in multiple stages. During the stages of designing and evaluating the eHealth intervention the input of users is especially important (Gemert-Pijnen et al., 2018). When designing an eHealth intervention, the needs of the target group are taken into consideration. While the BdB-app is tested and altered based on user evaluations (Laurens et al., 2020), the design of the app is based on users without MBID. As discussed above, interventions designed for the general population are often not effective for individuals with MBID. Therefore, there is a need for testing and examining what needs users with MBID have regarding CBM training. This is why, in this study, the usability and acceptability of the new version of the BdB mobile application is investigated with individuals with MBID.

The second version of the BdB-app is able to measure bias towards alcohol in the app. The BdB-app uses a mobile translation of the AAT designed by Wiers and colleagues (2010). The AAT by Wiers et al., (2010) is a desktop version that allows participants to push and pull using a joystick. Translating this task to a smartphone or comparable mobile device increases accessibility and usability in research, but, it also raises questions about validity and reliability of this method (Zech, Rotteveel, van Dijk, & van Dillen, 2020). Kersbergen, Woud, & Field (2015) conclude in their study that relevant feature version of the joystick AAT predicts hazardous drinking and also predicts alcohol consumption. Versus an AAT version where participants focussed on irrelevant features, which did not predict hazardous drinking. Zech and colleagues (2020), found that a mobile AAT, aimed at approach bias towards happy and angry faces, is able to detect approach bias. Although, results did not correlate with the joystick AAT. Zech et al., (2020) theorize that contextual factors could influence the strength of the cognitive bias. Moreover, Meule and colleagues (2019) and van Alebeek, Kahveci, & Blechert (2021) found a reasonable reliability of a touchscreen AAT-measure to assess food-approach bias. Brouwer (2019), Balci (2019) and Verhoeven (2021) all found no evidence indicating the AAT in the BdB-app was able to measure alcohol approach bias, but these findings could be due to a small sample size. To conclude, the reliability and validity of mobile measurement of approach tendencies has not yet been established and thus needs more research.

The first aim of this study is to evaluate the acceptability and the usability of the BdB-app for individuals with MBID. This includes downloading and setting up the app, the personalisation of the app, AAT training sessions and AAT bias measurement sessions. Outcomes of this study will contribute to redesigning the app to the needs of individuals with MBID. The secondary aim of this study is pilot-testing the bias measurement at baseline and end of treatment for a future RCT for individuals with MBID. Research questions of this study are:

- How do participants with MBID experience downloading and installing the BdB app?
- How well do participants comprehend the functions and the purpose of the app?
- How do participants perceive completing training sessions in the context of their daily lives?
- Under what circumstances do participants perform training sessions?
- How well do participants adhere to a daily training protocol?
- What reminder system fits participants needs to support adherence to the training protocol.

2. Method

2.1 Study Design

This study is a mixed methods design, commonly used in user experience evaluation of eHealth applications (van Gemert-Pijnen, Kelders, Kip, & Sanderman, 2018, ch. 14). In this study a total of four different methods were used: a questionnaire, qualitative interviews, log-data and a pre- and post-test of approach bias.

This study was approved by the ethics committee of the faculty of Behavioural, Management & Social sciences of the University of Twente (approval number: 200991), moreover the research ethics committee of the Radboud University found that this study would be conducted in accordance with applicable legislation (file number: 2021-7393).

2.2 Participants

Participants were ten individuals with MBID (IQ 50-85), recruited in two care facilities and one day care/expertise centre for individuals with MBID through convenience sampling (Babbie, 2016). Half of the participants were directly approached by the researcher. Other participants were approached by caretakers.

Inclusion criteria:

- Individuals with MBID;
- In possession of a personal smartphone;
- Are aged eighteen or over;

Exclusion criteria:

- Any current substance abuse treatment;
- Insufficient understanding of the Dutch language;
- Severe visual or motoric (hand) disabilities.

A set of inclusion and exclusion criteria was composed. Inclusion criteria were adapted during the research. The first set of in- and exclusion criteria included requirements about self-reported alcohol intake, namely: *Self-reported alcohol consumption during the past 6 months (or during at least a 6 months period in the past 2 years) of at least 7 standard glasses weekly, or at least once a month heavy episodic drinking of 6 standard glasses at a single event*. Exclusion criteria stayed the same over the course of the research. The alcohol related inclusion criterium was removed, because it proved complex to reach individuals that satisfied this criterium.

2.3 Intervention

This study conducted a usability test of the second, adapted version of the BdB-app. This version of the app launched March 2021 in the Google Play Store. The mobile application was only available for devices with an Android operating system. As was explained in the introduction, the application aims to change implicit bias towards alcohol via CBM.

The main function of the BdB-app is CBM through AAT training sessions. The application uses multiple active ingredients, such as motivational messages, error messages and a diary like function. When first using the app, users are asked to create an account. After creating this account, users create a personalized picture set that is utilized during training and measurement sessions. Users selected between ten and twenty pictures of alcoholic beverages and non-alcoholic beverages. The picture set used in the app is a combination of pictures from the Amsterdam Beverage picture set (Pronk, van Deursen, Beraha, Larsen & Wiers, 2015) and pictures taken by the designers of the app. Next, users complete a bias measurement consisting of 40 pictures. Before users start training sessions they receive questions about their well-being and alcohol intake since the last session. Then, users are able to start training sessions. Training sessions proceed as follows: a total of 100 pictures, from their personalized picture set 50 pictures of alcoholic beverages and 50 pictures of non-alcoholic beverages are presented. Users are instructed to swipe away pictures that contain alcoholic beverages and swipe non-alcoholic beverages towards them. They are instructed to respond as quickly as possible, and to avoid mistakes. A short error notification, in text and sound, is given when users reacted too slowly, make a mistake or when the swipe movement is performed incorrectly. Upon completing 30 and 70 pictures users get a motivational message, for example “you are doing well”. After every session a short overview with scores, time and a percentage of correct responses is given. Moreover, participants are able to compare their current score with scores of previous sessions.

2.4 Materials & Data-Analysis

2.4.1 Questionnaire

A questionnaire (Appendix A) was created prior to the start of the research, to measure baseline alcohol use and to inform about the demographic data of participants. The questionnaire consisted of multiple components, with a total of 39 questions. First, some demographic questions, followed by questions about living situation, alcohol accessibility and motivation for change. In total this first section contained nine questions. Secondly, participants replied to nine items of the Smartphone Usage subscale of the Media and Technology Usage and Attitudes Scale (Rosen, Whaling, Carrier, Cheever, & Rokkum, 2013). The original items (see Appendix B) were translated and adapted to better suit the target audience because the original items could be possibly confusing or unclear for participants. For example, item 2 *“Get directions or use GPS on a mobile phone”* of the original questionnaire was adapted to *“Ik gebruik mijn telefoon voor het vinden van de weg*

(bijvoorbeeld Google Maps)". Rosen and colleagues (2013) report a Cronbach's alpha coefficient of .93 of the Smartphone Usage subscale. Next, each participant filled out their alcohol intake in the past seven days. For this research an adapted version of the Dutch translation (Wiers, Hoogeveen, Sergeant & Gunning, 1997) of the Time Line Follow Back (TLFB) (Sobell & Sobell, 1992) was used. The TLFB used in Somsen (2017) used the standard drink conversion chart, so participants could converse their alcohol intake into standard glasses. The chart and explanation were removed for this study, as it could be confusing for our participants and could lead to participants filling out wrong answers. Therefore, an alternative explanation was given (see Appendix A). The TLFB is found to be valid when used on sober participants (Wiers et al., 1997). Furthermore, the ten items of the Dutch version (Schippers & Broekman, 2010) of the Alcohol Use Disorders Identification Test (AUDIT) (Babor, Higgins-Biddle, Saunders & Monteiro, 2001) were used to screen for hazardous alcohol use. Reliability of the AUDIT is high (r = .86) as well as the validity (between .80 and .90).

Data-analysis. For statistical analyses of the questionnaire IBM SPSS Statistics, version 27, were used. To describe baseline characteristics of the eight participants that filled out the questionnaire, descriptive statistics were used. Question 38 - 1 and Question 40 - 4 are recoded to match the other questions in these sections. Moreover, the items of the Smartphone Usage subscale of the Media and Technology Usage and Attitudes Scale were scored 1 (never) – 10 (all the time), scores on all items added together equivalents the total score on this scale. For the TLFB the sum of the units per day equal the total score on this scale. Items of the AUDIT were scored 0 – 4, with the total score calculated by the total sum of each item.

2.4.2 Log-Data

Implicit Bias Measurement. Before the first session (base-line) and after the last session participants were asked to complete a measurement session in the BdB-app. The BdB-app bias measurement method was an adapted version of the AAT for smartphones as recommended by Laurens et al., (2020). Participants first got the instruction to perform a bias-incongruent task (avoidance of alcohol). After 20 pictures, the swipe movement changes, participants were then asked to complete a bias-congruent task (approach of alcohol). The swipe movement made by participants and the zooming feature of the pictures in the app mimic the sensation of approach and avoidance. In total participants swipe a total of 40 pictures; 20 alcohol pictures and 20 non-alcohol pictures.

Data-analysis. To analyse and compute the bias scores of participants, IBM SPSS Statistics, version 27, was used. Analysing bias scores in this study is based on the application of an adaptation of the D-algorithm designed by Greenwald et al., (2003) (Wiers et al., 2011). RT below 200 milliseconds and above 2000 milliseconds were filtered out as well as wrong reactions, e.g. participants swiped alcohol pictures towards them instead of away. These values were replaced with a penalty score based on their personal RT. Moreover, if a task contained 25% or more error trails and/or extreme RT, the task was excluded from further analyses (Wiers et al., 2009). Calculating the alcohol approach D - score and the alcohol avoidance D - score was done by subtracting the approach

RT mean from the avoid RT mean, the score was then divided by the standard deviation (or inclusive SD). Relative D - score (bias score) was calculated by retracting the non-alcohol D - score of the alcohol D - score. Formulas looked like this:

$$Alcohol\ D = \frac{MEAN\ RT\ avoid\ alcohol - MEAN\ RT\ approach\ alcohol}{Inclusive\ SD}$$

$$non\ alcohol\ D = \frac{MEAN\ RT\ avoid\ non\ alcohol - MEAN\ RT\ approach\ non\ alcohol}{Inclusive\ SD}$$

$$Relative\ D\ score = alcohol\ D - non\ alcohol\ D$$

User data. The BdB-app stored data on their users. The data used in this study is the number of completed training sessions and self-reported alcohol use.

2.4.3 Interviews

Participants partook in a semi-structured interview of 30-60 minutes. Interviews were conducted online via Microsoft Teams or in person, depending on COVID-19 measures. Before starting the interview, participants were notified about the recording of the interview and were notified they could stop the interview at any time. For every topic a starting question was formulated, with multiple possible follow-up questions. The interview scheme can be found in Appendix B. The researcher was able to freely formulate questions in a manner suiting participants. Topics discussed include: installation of the app, usage of the app and utility, ease/burden of use, context of use, adherence, reminders, perceived efficacy and points of improvement. The interview scheme consisted of 22 questions across eight topics. The topics and starting questions were formulated based on the interview scheme of earlier usability tests of the BdB-app and information of Tactus, as the developer of the app. Literature was used to refine the interview scheme (Finlay & Lyons, 2001; Miltenberger, 1990; Sekhon, Cartwright, & Francis, 2017). Moreover, the researcher noted observations during the interview. The observations were discussed with the participants at the end of each interview.

Data-analysis. To analyse the data the recordings were transcribed and coded. During transcription the interviews are made anonymous and all personal data was removed. After transcription a codebook was formed (Appendix C). The initial codebook was compiled after the first reading of the interviews using thematic analysis (Campbell, Quincy, Osserman, & Pedersen, 2013; Roberts, Dowell, & Nie, 2019), codes were matched to the pre-existing topics: Installation of the app, Support, Reminders, Ease/Burden of use, Context of use, Adherence, Perceived efficacy and Points of improvement. The first version of the codebook was discussed with a senior researcher. After feedback and a second reading of the interviews the codebook was revised to a second version. Subsequently, the codebook was reviewed and discussed with a peer researcher, after which adaptions were made to make the final codebook version unambiguous. The eight topics are subdivided in 29

codes. Transcriptions were coded using Atlas.ti software, by a single researcher. After coding, topics were analysed per topic and codes/topics were crossed analysed.

Some participants talk about their own experiences and also theorize how peers might experience the same situation or obstacle. During analyses and in the results section of this study own experiences and possible experiences of peers are separated.

2.4.4 Triangulation

After the initial data-analysis, qualitative data (e.g. bias measurements, log data and data of the questionnaire) was used to support, explain and enrich the qualitative data from the semi-structured interviews. Multiple methods of data selection were used to reach more extensive and complete answers to the research questions (Bartholomew Eldredge, 2016; van der Donk & van Lanen, 2012).

2.4 Procedure

Prior to participation informed consent was obtained after participants received a patient information letter. The researcher provided an oral explanation of the research procedure to the participants, and to their caregivers if applicable. All questions regarding participation were answered before signing the informed consent. After, the researcher verified the type of smartphone a participant possessed. If this was any type other than a smartphone with an Android operating system the participants were informed about the possibility to receive a loaner phone for this research.

The first step in participation was filling out the digital questionnaire, which eight participants completed. After, the app was downloaded and installed. Due to COVID-19 there were three different approaches towards participation. The first group ($N = 2$), received a digital guide about installing and downloading the app. The participants were given the opportunity to ask questions or receive help if needed. They were instructed to complete a training session every day for seven days. Then, after seven or eight days the interview was conducted as well as a second bias measurement.

The second group ($N = 5$) filled-out the informed consent, the questionnaire, downloaded and installed the BdB app, and performed the first bias measurement and first training session while the researcher was present. They were instructed to follow the training protocol of a training session a day for seven days. After these seven days the researcher conducted the interviews face-to-face and the last bias measurement was completed.

The third and final group ($N = 2$), participated in a testing day. The testing day entailed the questionnaire, the installation of the app, which was already pre-downloaded with an account on smartphones brought by the researcher, do a bias measurement, a training session and the interview all over a course of one afternoon. This group was not able to complete a second bias measurement, due to settings within the BdB-app. The app does not allow users to conduct two measurement sessions within a 24-hour period.

3. Results

3.1 Sample description

Table 1 gives an overview of the demographic variables of the participants. One participant dropped out after the questionnaire. Nine participants finished the research. Unfortunately, questionnaire data of one participant is irretrievable. The mean age of participants is 31.6 years with a minimum age of nineteen, while the oldest participant is 50 years old. Most participants identify as male ($N = 5$), two as female and one participant as non-binary. Most participants ($N = 6$) are unpaid employees and two participants have a paid job. Five participants live with roommates and three participants live alone. Two participants receive extramural care, the other six participants live within an institution. On the smartphone usage subscale of the Media and Technology Usage Scale participants scored between 20 and 72 ($M = 44.9$, $SD = 16.5$) out of a maximum of 90.

Overall, alcohol intake of participants can be considered low. Audit scores vary between zero and six, the mean AUDIT score is 2.3 ($SD = 2.4$). TLFB scores vary between zero units and ten units of alcohol in the past week, with a mean of 2.1 ($SD = 3.6$). In the interviews three participants indicated that they are abstinent, three participants drink alcohol infrequently and two participants drink alcohol regularly. The log-data of eight participants shows all but one participant was abstinent during their participation. None of the participants received treatment for alcohol use in the past.

Table 1

Baseline questionnaire results

Variable	*N*	%
Age (years), mean (*SD*)	31.6 (10.1)	
Gender		
Male	5	62.5
Female	2	25
Non-Binary	1	12.5
Employment		
Paid employment	2	25
Student, day care activities and/or unpaid employment	6	75
Living situation		
Alone	3	37.5
Together with roommates	5	62.5
Received care		
Intramural	6	75
Extramural	2	25

Treatment for alcohol (ab)use		
Not at all	8	100
Alcohol intake		
I don't drink or I don't drink much	6	75
My alcohol intake is normal	1	12.5
I sometimes drink too much	1	12.5
TLFB, mean (*SD*)	2.1 (3.6)	
AUDIT, mean (*SD*)	2.3 (2.4)	
Smartphone usage subscale, mean (*SD*)	44.9 (16.5)	

3.2 Acceptability and Usability of the BdB-app

Below, in table 2, an overview of topics, codes and the number of quotations for each code is given. In the text below, cursive text indicates the codes that are represented in the paragraph. The number of quotations of a code does not necessarily indicate a high importance of the code to participants.

All participants rated the BdB-app on a scale of one to ten, with one being "using the app is really hard" and ten would is "using the app is super easy". One participant rated the BdB-app insufficient (5). Eight participants graded the app sufficient, or good. On average participants grade the BdB-app with an 8.1, which is well above adequate. Participants explained using the app is easy and straightforward from first use.

Table 2

Overview of topics, codes and quotations

Topic	Codes	Quotations
Installation of the app	Downloading in PlayStore	14
	Creating account	8
	Selecting pictures	24
Support	Help by caregivers	16
	Help by researcher	36
	Help by others	7
Reminders	In-app reminders	7
	External reminders	8
	Cues	2
Ease of use/ Burden of use	Unobtrusive	9
	Obtrusive	6
	Daily Routine	10

	Navigation	15
	Features	29
	Usability	38
	Technical Problems	7
	Text	8
Context of use	Environment	15
	Time of day	12
	Distractions	10
Adherence	Number of training sessions	11
	Helping adherence	23
	Hindering adherence	25
	Perceived ease of adherence	13
Perceived efficacy	Alcohol intake	17
	Working Mechanism	28
	Future use	12
Points of improvement	Points of improvement	22

3.2.1 How do participants with MBID experience downloading and installing the BdB-app?

The downloading of the BdB-app from the Google *Play Store* appeared easy for android users. *Creating an account* and *selecting pictures* is mostly straightforward for participants, although, the opinions are mixed about the contents of the pictures. Participants received *help of the researcher* during these steps.

Four participants received a loaner phone with the BdB-app downloaded onto the device. Five participants downloaded the BdB-app themselves. One participant who uses an iPhone in their daily life, needed help with downloading the app in the Play Store: “I can download things, but Android is just not my thing”. Four participants did not encounter any problems while downloading the app in the Play Store, to illustrate: “As a phone addict I found it easy”. Five participants did not need or receive help while creating an account. Four participants made it known that creating an account was easy and straight forward “In itself it was not very difficult, no”. One participant did need help creating an account. This participant might be digitally illiterate, as they scored 30 on the smartphone use subscale. Nevertheless, another participant scoring 35 on the smartphone usage subscale did not report these difficulties.

After, participants selected pictures to personalise CBM training sessions. As seen above, some participants are non-drinkers. While selecting pictures, two participants choose alcohol that is consumed by their environment. To illustrate: “My environment drinks alcohol, so I know what they are. Basically, it wasn't really hard for me to choose the pictures” and “My father was an alcoholic. So, I saw quite a lot of alcohol”. Five participants found the process of selecting pictures comprehensible.

As an example, “That was fun” and “That's three, that's four, not beer. And that's five, no. Six, seven, eight, nine, ten. And then save?”. Two participants demonstrated difficulty selecting pictures and asked for a demonstration by the researcher. Three participants were unable to tell how many pictures they selected, despite the counter, “How much pictures did I select? […] Where can you see that?”.

Interestingly, the contents of some pictures were rated as ambiguous by two participants. For example, “But what is the difference, because this is Malibu and this is also Malibu?”, when pointing out pictures with a full glass, with an empty glass and without a glass. Additionally, one participant stated: “Because Radler is usually 0.0. So, at first, I thought that was 0.0 and that you could swipe it towards you, during a session. But you have to swipe it away. […] I actually never drink Radler. But when I do it's always 0.0. So, for me personally, I don't easily make the link with alcohol at the Radler”. Also, three participants missed pictures of alcohol they like such as Jack Daniels, Hugo and cans of beer.

3.2.2 How well do participants comprehend the functions and the purpose of the app?

During the interviews, participants talked about their experiences with the different functions of the app. Mentioned *features* were: *navigation* of the app, the diary, *text* within the app, bias measurement, and training sessions. Overall, participants do not display to comprehend the *working mechanism* and purpose of the app. Nevertheless, participants are able to understand the different functions of the app and were positive about the *usability* of the functions.

Navigating the app rendered problems for some participants. For example, two participants were unable to find the home menu. One participant pressed the words home menu in the text instead of the home button. Another participant used the home button of the device. It should be noted the last participant is used to an iPhone. One participant therefore suggested the substitution of the current home button. Three participants experienced other problems navigating the app. For one participant this can be related to digital illiteracy. For others complications regarding navigation were related to text. To illustrate, “The small text makes me dependent on others to read. If it was possible to enlarge the text I could read it myself”. Difficulty to understand text is reported by one participant, whereas an inability to read these texts was discussed by three participants. One participant stated: “For individuals with a lower level of literacy the app needs to contain video or pictograms”. To improve the usability and readability of the app three participants suggested adding videos, pictograms or a reading function for individuals that experience difficulty reading small print or text in general, due to dyslexia for example.

The diary feature was used by seven participants of whom half liked the function and half disliked the function. Three participants enjoyed this feature “I felt it was nice, because then I could say what I experienced, what bothered me or if I didn't feel well” and “I liked these questions. You see if you really drink a lot, you might be able to reflect on your drinking habits. Because then you start thinking about it “Oh, how much did I drink over the weekend?”. […] And you might think that you should drink a little less, or if you are severely addicted, that you should stop drinking alcohol

altogether". On the other hand, three participants report disliking the feature, for two separate reasons. First, the inability to modify alcohol intake during the day and secondly the fact that the app pre-selects one of the potential answers to a question. To illustrate, "Well, when I had to fill out "Hoe gaat het?", I tended to press "goed" while you couldn't press that, because it already was selected. [...] I actually think that it should not be filled in. Because maybe it doesn't go well". One participant suggested adding cup measures for filling out alcohol intake. Their reasoning: users can also fill in one bottle instead of one glass.

Training- and measurement sessions are mostly viewed as easy and straightforward. Training sessions are compared to games, by one participant. One participant stated: "At a certain point you see, if you, for example, swiped water up, it will be stated that it is not alcohol or something like that. Or that you have to swipe it down. And with alcohol if you swipe it down, it said that it had to go up. That's also something I really liked". Despite participants being generally positive about the training sessions, some participant experienced annoyances. For example: "I am often distracted by those notifications that say: dude, keep it up". Two participants mentioned that they would lose their focus when swiping too quickly and four participants mentioned making mistakes was frustrating. One participant would appreciate fewer alcohol pictures during training sessions. The pictures of alcoholic beverages might increase craving. On the contrary, one participant wants a reduction of non-alcohol beverages, as these do not evoke negative health outcomes. A clearer distinction between non-alcoholic and alcoholic beverages is also put forward by one participant. Lastly, one participant suggests the app should not be personalized, so it is possible to learn about beverages that are not preferred. During bias measurement sessions, four participants experienced the change of swiping direction as sudden and confusing. As an example, "The only annoying thing was that every now and then you had to go in a different direction. And then you lost it. [...] then I was like, what should I do now? Oh yeah, I remember".

The purpose of the app is described in various ways, such as increasing knowledge or influencing impulses. Generally, participants describe an increase in knowledge about alcohol. Moreover, they report to have increased awareness of the adverse health risks of alcohol. For example: "The measurement session for the alcohol and the training session to realize that you can't just start drinking. That you end up on the street or something because you are so addicted". Two participants state the app might influence impulses regarding drinking behaviour. To illustrate: "If you play on the subconscious. For example, if I'm sitting somewhere with my friends and I say "here have a beer" and then you automatically say "Yes, nice!". Then I see the app helping".

Participants are unsure of the ability of the BdB-app to change behaviour. Three participants think the app is able to help peers to decrease alcohol use. For example: "I'm sure that can help". One participant is not convinced about the possibility to create behaviour change, and two participants think the app might increase alcohol use. Additionally, two participants indicate motivation to decrease alcohol intake is vital to creating behaviour change. For example: "If individuals would use it

often I think yes. Maybe not for some. They might just delete the app and continue to drink". Furthermore, two participants suggest the app can act as extension to another intervention.

3.2.3 How do participants perceive completing training sessions in the context of their daily lives?

Generally training sessions are seen as *unobtrusive* to the daily life of participants, and participants do not report needing *help of caregivers or others* using the BdB-app.

Not all participants implemented training sessions in their *daily routine*. Three participants had not incorporated training sessions into their daily routines. To illustrate, "I haven't found a good time yet and that's not just in this regard, but also with fun activities". On the contrary, two participants implemented the daily training sessions into their routine "Training sessions became part of my morning routine. So that was checking social media, doing the app, brushing your teeth, getting dressed and leaving for work". A more detailed description of the context (including time) in which training sessions are completed can be found in paragraph 3.2.4.

Opinions about the level of obtrusiveness of the training sessions were divided. Four participants explained daily BdB training sessions had little impact on their daily life. Completing training sessions was not seen as a burden on other daily activities. "I think it is good to do it every day and it doesn't take much time either". As stated above, training sessions are seen as quick by a total of three participants. Three participants state they might be unable to make time for training sessions in their daily life, quote: "At the moment it is doable. I'm on sick leave now, but if I go back to work… I don't know". One participant mentioned doing training sessions tired them and costs a lot of energy, but they were unable to clarify further. Moreover, two participants also pointed out they might be reluctant to complete training sessions when following this training schedule for a longer period of time "Probably because I don't have time for it, or maybe even because I don't feel like it anymore, late at night. If I've already worked and cooked and done everything I'm supposed to do". Additionally, forgetting training sessions made it hard to implement training session in their daily routine, one participant mentioned. One participant explicitly stated that doing sessions evoked cravings towards alcohol "The app makes me want to drink in the evening. But that's not allowed here".

Overall, participants did not need help for completing training sessions "If I speak for myself, I do not think I need it". None of the participants reported getting help of caregivers during the trail. Help by caregivers could be useful for peers, six participants stated. A distinction is made between help aimed at decreasing alcohol use and help aimed at the usability of the app. Some participants suggested a coaching or monitoring function for the caregiver. To illustrate, "It is important the caregiver provides feedback on drinking behaviour for example, compliment a client when they drink less or calling out a client when they lie about their drinking behaviour". Others suggest a helping role for caregivers during installation or to give reminders for adhering to the training schedule, "I think caregivers could help to remind you of a training session".

3.2.4 Under what circumstances do participants perform training sessions?

The *environment* in which the training sessions are completed is predominantly at home, during a *time of the day* fitting to the schedule of the participants.

Participants whom followed the seven-day training schedule ($N = 7$) primarily completed training sessions in their own home. Three participants mentioned also doing training sessions in other places. For instance, two participants irregularly completed training sessions at work and one person mentioned completing training sessions in their partners' home. "It was a bit more difficult at work, because I was very busy, so it was difficult to concentrate on the app, but it worked out in the end". There are two rooms that all participants prefer, the living room or the bedroom. Four participants mentioned doing training sessions in the living room, one of these participants lives independently. For two participants living in a group home, the presence of other residents is not a problem "they can just walk in. As long as they don't bother me too much, when I'm busy". Five participants completed sessions in their bedroom, four of which reside in a group home. To illustrate: "Most of the time I'm still in my bed, while doing the app. First checking social media, duh every morning, and then "oh I have some time left" and then I'll grab the app".

The time of day in which participants chose to complete training sessions varied. Three participants did not have a fixed time for completing sessions, "Sometimes in the evening, sometimes in the afternoon, it differs". Two participants did a training session when they felt there was enough time to complete one. For example: "Sometimes you just don't have time in the evening, that's it" or "It also differs a bit per day or how busy I am in a day". One participant mentioned completing training sessions in the morning. Two participants usually finished sessions during the afternoon and one participant had a preference to do training sessions late at night.

Generally, participants are not hindered by *distractions* while completing training sessions. Two participants stated they could mentally block other stimuli or individuals that might distract them, to illustrate: "I can just shut myself off completely and just calmly: one, two, three…". One person created a distraction free environment before starting a session. Lastly, one participant noted that they left when the environment became distracting and finished training in their bedroom.

3.2.5 How well do participants adhere to a daily training protocol?

The self-reported *number of training sessions* is sufficient, with most participants adhering to the training schedule. Factors *helping adherence* are a sense of obligation to the research project and having sufficient free time. Time limitations and feeling tired are put forward as factors that *hinder adherence*. In general participants describe the training schedule as feasible.

According to the self-reported level of adherence of seven participants, participants can be categorized in three groups: a group which reports completing seven or more sessions, a group that reports doing less sessions than instructed, and a group that does not know the number of completed training sessions. Four participants reported completing seven or more sessions, to illustrate "I did one every day, but I also had days when it was a measurement session, but I didn't know if it really counts.

I thought maybe that's just exercise, so I might have done two in a day. So, I've done maybe 11 or 12". Some participants may have counted bias measurement sessions in their assessment, as the previous quotation clarifies. Two participants explained they finished approximately five sessions, these participants did not disclose whether they included bias measurements in their assessment or if they only included training sessions. Moreover, one participant disclosed they are clueless about the number of sessions they completed "I can't remember exactly how many but I think I certainly reached seven". According to the log-data participants competed between two and ten training sessions during their week of participation, with a mean of 5.2 training sessions (*SD* = 3.4).

Participants primarily attribute adherence to having free time and a sense of obligation. First, having enough time to complete a training session is implied to help adherence by three participants. To illustrate, "[What helped you to do the sessions?] That I was at home a lot". Three participants explained they completed sessions because of a sense of obligation towards the research project. To illustrate "Because some days I didn't really feel like it, but then I thought: it is for Chantal's school. So yes, I will do it". Moreover, the neglectable time investment helped two participants to adhere to the schedule. Feeling ownership over training sessions was important for one participant, to illustrate: "that there was a kind of personal choice". Lastly, one participant devoted adherence towards their personality, in particular towards being a 'man of action', "It's in my character, I guess. I'm a big go-getter so I won't give up so quickly doing a session".

Participants illustrated different factors which hindered their adherence, like time limitations and feeling tired. Having a busy day or week hindered adherence according to four participants. For instance, "Research in the hospital and important conversations" was one explanation given for not adhering to the schedule. In like manner, two participants explained feeling tired was a reason to skip a session "Yesterday I couldn't do it because I was tired". Similarly, two participants reported "In the evening I don't feel like doing anything anymore". Making mistakes reduced motivation to complete training sessions according to two participants. As an example, "What I find difficult is that sometimes it is too fast and then I swipe in the wrong direction. See, here I have a high score, there and low, there again a high and there again a low. And twice the same score". The previous quotation also illustrates a lack of progress could also form a barrier for adherence.

Overall, participants experienced the training schedule as feasible, but also mention some limitations. Five participants expressed a seven-day training schedule is a good schedule to follow, as an example "Yes, in itself nice to try. Yes, I found it fairly easy". One participant mention they want to complete more sessions per day to increase their score. When implementing training sessions into their daily life, one training per day might be too much, according to two participants. To illustrate, "I think I would start using it less. Because of work, if I go back to work I will use it much less anyway. […] I think twice, once or twice, or I need to be in a good mood or something, I could also do it one evening during the week, if I even think about it".

Seven participants talk about the perceived influence of the BdB-app on their alcohol use. Two participants explained they did not feel motivated to reduce their alcohol intake, “No, that sporadic glass of wine I consume. I think that should not be a problem”. Secondly, the BdB-app possibly helped two participants to reduce their drinking, although it was a too short time a period to evaluate this, “[Did BdB help you to reduce your alcohol intake?] Yes, that's hard to say in my situation. But that could well be”. On the contrary, one participant recons no influence on drinking behaviour by the BdB-app, quote: “First of all, of course it's still too short, I've had the app since Saturday. But I don't think it really affects me. Like I said I'm not an impulse drinker. I'm really the 'I deliberately choose Friday evening to sit on the couch with a few beers and a movie' – type”. Moreover, one participant experienced craving towards alcohol while training, they stayed abstinent because of agreements with their institution.

Three drinkers mentioned future use of the BdB-app. One participant does not know if they are willing to use the app again. Another participant mentioned they might use the app if they notice their drinking increases “Maybe I'll use it from time to time, yes. Maybe when I have a period when I'm not feeling well or something and I notice that I might drink a little more alcohol or something”. Additionally, this participant mentioned they would like to use the BdB-app if they want to quit drinking entirely. Lastly, one participant explained they would remove the app from their phone when he was finished with this research and would not consider the BdB-app when quitting alcohol, because they feel like it would not apply to their situation, “Not in my case, I don't find my use problematic. It's also true that I can go without it for weeks, months and sometimes even years if I want to. So, I don't need that to stop drinking”.

3.2.6 What reminder system fits participants needs to support adherence to the training protocol?

Most participants were reminded to do training sessions by an *external reminder* system or by environmental *cues*.

Participants did not receive *in-app reminders*, because of the programming of the app. One participant stated that it might be risky to set in-app reminders due to possibly building an addiction to the BdB-app, quote: “I don't think there should be reminders. […] Because it will be the same as with those freemium games. It even became a meme on South Park at one point. You will get the same effect as a slot machine. That sound and those beeps then trigger the game brain and individuals might become addicted to the game. Now this is completely free, but with freemium games they also try to trigger you to make micro-payments. If you do that with this, what you will get is exchanging one addiction for another”. On the contrary, one participant suggested that in-app reminders could be helpful for peers that would like to lower their alcohol use “Because I imagine that might be nice. But I also hardly drink. I can imagine that someone who drinks quite a lot may need that”.

Four participants talked about the use of external reminders and two participants mentioned environmental cues which functioned as a reminder. One participant set up an alarm to remind themselves to do a training session each day “Sometimes I do get the reminders and I was like oh,

right". Likewise, one participant suggests setting up external reminders in a planner app or using caregivers as a reminder system. Two participants talked about just being able to remember to do training sessions without any type of reminder "I got the app and ever since, I thought oh yeah I have to follow that training session. Then I'll remember. So that, that's really nice". Two participants mentioned that seeing the smartphone they used for this research functioned as a reminder "then I saw the phone lying there and I thought, yes oh okay, and then I clicked on start, and then I'm glad I did". In short, most participants reminded themselves to do the training sessions, without any help from reminder systems although (un)conscious reminder systems were helpful for other participants.

3.3 Pilot testing bias measure

During the study nine participants completed one or more bias measurement session in the BdB-app. Unfortunately, the data of three participants did not transfer to the server of the app. The other six participants completed between one and three measurement sessions during the trial period. Participants who followed the seven-day training schedule completed respectively 1, 2, 2 and 3 measurement sessions. The two participants whom participated in the day testing group completed one bias measurement each before completing a training session. A total of ten bias measurement sessions, containing 400 trails, were obtained from the log data. Of these 400 trails 49 can be categorized as too slow (>2000 milliseconds) and a total of 24 trails are considered to be errors. Per pre-determined exclusion criteria for data, four measurements which counted eight or more false answers and/or with RT < 200 milliseconds or RT > 2000 milliseconds are entirely excluded from analysis. Thus, six measurement sessions, of four participants, were deemed fit for analysis. Three pre-test measurement sessions and three post-test measurement sessions.

At pre-test, two participants have a negative *D*-score, which indicates avoidance tendency of alcoholic drinks. Their relative *D*-scores are -1.81 and -0.15. One participant scored a relative *D*-score of 0.84, which indicates an approach tendency towards alcohol. Consequently, three participants completed post-test bias measurements, of which two participants had negative *D*-scores of -2.16 and -0.33. One participant has a positive relative *D*-score of 0.39.

Two participants completed a pre- and post-measurement session. The first participant shows a decline in approach bias, from a relative *D*-score of 0.84 at pre-test to a relative *D*-score of -0.33 at post-test. The second participant showed an increase in approach bias, with a relative *D*-score of -0.15 at pre-test to a relative *D*-score of 0.39 at post-test. During the exit-interview this participant mentioned increased craving towards alcohol, during the training sessions.

Both participants whom completed a pre- and post-measurement session reported an alcohol intake of zero. Interestingly, the one participant that experienced increased craving towards alcohol also showed an increase in alcohol approach bias.

4. Discussion

In this study the main aim is testing usability and acceptability of the BdB-app among individuals with MBID. CBM seems like a promising intervention for individuals abusing alcohol, considering the positive results of some past studies (For example: Eberl et al., 2013; Laurens et al., 2020; Rinck et al., 2018; Wiers et al., 2011). Yet, little is known of the usability of CBM in the general population (Beard, Weisberg, & Primack, 2012), and this statement applies especially for individuals with MBID. To add, most existing interventions targeting alcohol abuse are not designed with individuals with MBID in mind (Kiewik et al., 2017; van Duijvenbode, Didden, Voogd, et al., 2012), this also applies to the BdB-app. Therefore, it is important to conduct studies aimed at improving and/or designing interventions targeting alcohol abuse for individuals with MBID. To establish the usability and acceptability six research questions were drafted targeting user experience. The second aim of this study is pilot testing bias measurements in the BdB-app among individuals with MBID in preparation for an RTC. A pre-test questionnaire, an exit-interview and log-data were used to test the usability, acceptability and the bias measurements of the app, for nine individuals with MBID.

Overall, the BdB-app is considered to be acceptable and usable for users with MBID, although some improvements would increase the acceptability and usability for individuals with MBID. To increase usability of the BdB-app for users with MBID it is important for designers to implement changes suggested in this study, in addition to involve this user group in the design process (Gemert-Pijnen et al., 2018). Moreover, to increase acceptability of the BdB-app a thorough implementation plan aimed at context of training sessions, performance expectancy and training schedule is needed. Unfortunately, based on the data of the current study, no inferences can be made on the psychometric quality of the bias measurements. Thus, more research is advised.

4.1 Usability and Acceptability of the BdB-app

4.1.1 Usability

In this study users are mostly positive about the usability of the BdB-app. Users describe the main feature of the app as easy and straight forward, just like downloading the app from the PlayStore. Resembling the general population, individuals with MBID are using more and more technology in their daily lives (de Groot, Kaal, & Stol, 2022; Johansson, Gulliksen, & Gustavsson, 2021), and in their education, care and health (Bendixen, Fairman, Karavolis, Sullivan, & Parmanto, 2017; Wehmeyer et al., 2008). Using technology and specifically smartphone applications in daily life increases the ability to use smartphone interventions for individuals with MBID. While, individuals with MBID are able to use the same smartphone applications as the general population, this does not mean they have the same design needs. In the current study users highlighted aspects of the app that

need modification to fit their needs as a user group of the BdB-app. Features that need adjustment to increase usability are for example: picture set, the text used in the app and the navigation of the app.

The ambiguity of some pictures implies the picture set does not fully match with the needs of individuals with MBID. The picture set used in the BdB-app is partly The Amsterdam Beverage Picture Set which is validated for the general population by Pronk et al., (2015), and consists partly of new pictures created by the designers of the BdB-app. The results of the current study show individuals with MBID might have other needs regarding the picture set used in training sessions. During a study towards a picture set used in tasks like CBM, Van Duijvenbode, Didden, Bloemsaat et al., (2012) found individuals with MBID did not show difficulty comprehending the pictures. Although, in the study by van Duijvenbode, Didden, Bloemsaat, et al., (2012), individuals with MBID found alcohol related pictures less attractive compared to the general population. In short, more research is needed towards the needs of individuals with MBID regarding the picture set used in the BdB-app.

Writing a text and using vocabulary which is easily understandable for the readers is important for every text, but especially for text written for individuals with MBID (Fajardo et al., 2014). The BdB-app contains as little text as possible and therefore text was not expected to raise challenges during this study. Unfortunately, users still experienced difficulties with reading and understanding the text in the BdB-app. Literature shows that individuals with MBID often have a smaller vocabulary compared to the general population (Fajardo et al., 2014). Moreover, using long texts and sentences hinders readability of a text for users with MBID (Fajardo et al., 2014; Karreman, van der Geest, & Buursink, 2007). The text in the BdB-app is not adapted for people with MBID. Improving the readability of the text for people with MBID is important when implementing the app for this group. Improving the text can be done by writing less text, using a lower level of vocabulary and shorter sentences (Fajardo et al., 2014; Karreman et al., 2007). Moreover, it could be helpful to give instructions in person or via a short video, to teach individuals with MBID how to use the app (de Jong, 2021; Hammond, Whatley, Ayres, & Gast, 2010; Leinweber, 2021; Park, Bouck, & Duenas, 2018). To conclude, it is important to adapt the text used in the BdB-app to improve the usability for individuals with MBID.

Lastly, before implementing the BdB-app for users with MBID the app design has to be adapted towards the needs of individuals with MBID. Usability of the BdB-app for individuals with MBID could be increased by making small adoptions in lay-out, such as simplifying the lay out and using clear pictograms. After the adaptations, the next step would be evaluating the app by, for example, a randomized controlled trial (Gemert-Pijnen et al., 2018).

4.1.2 Acceptability

The BdB-app is an overall an acceptable intervention to use with individuals with MBID, when constraints are noticed. Context and time of training sessions, but also a fitting training schedule need to be considered before implementing the BdB-app into the life of users with MBID. Literature

about the acceptance of eHealth interventions is predominantly aimed at the general population, Individuals with MBID seem underrepresented in this field of research (Vázquez et al., 2018). The Unified Theory of Acceptance and Use of Technology (UTAUT) model of Venkatesh gives insight into the four determinants of user acceptance and usage behaviour (Venkatesh, Morris, Davis, & Davis, 2003). Performance expectancy, effort expectancy, social influence and facilitating conditions are the determinants of behaviour in the UTAUT model. Gender, age, experience and voluntariness of use are key moderators (Venkatesh et al., 2003). Acceptability of the BdB-app will be discussed using the determinants of the UTAUT model, with the exception of social influence as, this determinant is not a part of this study.

Facilitating Conditions. The context in which CBM training sessions are completed can have an influence on efficacy and acceptability of training sessions. In this study, training sessions were predominantly completed at home. Interventions via smartphone are easily accessible and are effortlessly used at home or in other contexts. Easy accessibility is theorized to have positive effects on treatment outcomes for people with MBID (Copersino et al., 2022; Watfern, Heck, Rule, Baldwin, & Boydell, 2019). Although, accessibility is a positive feature of an intervention it could also result in additional challenges. The users in the current study have not put much thought in the set and setting in which they completed training sessions, this could affect treatment outcomes. To illustrate, Kuckertz et al., (2014) found that treatment toward anxiety was more effective if anxiety was induced, so attentional bias is present. Wiers et al., (2018) found online CBM to be less effective compared to CBM in a clinical setting. Additionally, Jones & Sharpe (2017) theorized a lesser degree of attention to the training at home might influence treatment outcomes using mobile or online CBM. On the contrary, Niles et al., (2020) found no evidence of this phenomenon in their study of a mobile CBM training to reduce anxiety. Therefore, it can be hypothesized CBM training sessions may be more effective when users experience craving towards alcohol. Thus, it is beneficial to instruct users to complete training sessions in context where they would normally drink, this can be at home but also in a bar or café. Secondly, when training sessions are primarily completed at home, this can lead to distractions. The bedroom is preferred over the living room, especially for individuals that reside in group homes. As group homes differ in the number of clients, it is possible that a communal room is too tumultuous for completing training session. In this study users experienced distractions but did not associate distractions with being unable to complete training sessions. Individuals with MBID have weaker executive control (Peeters et al., 2012) and therefore might experience problems with concentration. Users being distracted while completing sessions might also explain the high number of bias measurement sessions with RT > 2000 m/s. It is plausible to think concentration during a training session will influence treatment outcomes negatively. As a result, users may benefit from instructions on planning their sessions regarding time and place. Additionally, future research can be focused on examining the impact of context on treatment outcomes.

Performance expectancy. The performance expectancy of the BdB-app by users in this study is poor, as users are not confident the app is able to change drinking behaviour. After a week of testing the BdB-app users overall stated training with the app increased their knowledge about the negative effects of alcohol. Whereas users perceived to have an increase in knowledge, they do not perceive the app to be beneficial in reducing alcohol intake. The perceived usefulness of an intervention is important for its acceptance and adoption (Venkatesh et al., 2003). Not having any perceived benefit, the app is likely the reason all users mentioned not wanting to continue using the app after this study. Additionally, perceiving the working mechanism of CBM is often important for users and can create more positive attitudes towards CBM (Beard et al., 2012).

Effort expectancy. Adherence towards the seven-day training schedule seemed adequate, in spite of previous conclusions about performance expectancy. Even when taking overreporting of adherence by users into consideration, compared to the number of completed training sessions observed data. A seven-day training schedule seems feasible for individuals with MBID, according to the results. For a seven-day training schedule there does not seem to be a need for reminders, although reminders can help users to adhere to the training schedule (Peeters et al., 2012). Relying on remembrance raises the risk of a breach in adherence. Thus, it might be beneficial to create an external reminder system, fitting the needs of the user. Factors that might negatively impact adherence in this sample are, amongst others, lack of motivation to change behaviour (Ryan & Deci, 2000), repetitive nature of the training sessions (Beard et al., 2012) and the perceived time investment. On the contrary, factors that might have positively influenced adherence in this sample are the easy accessibility of the app (Copersino et al., 2022) and, feelings of loyalty towards the researcher.

4.2 Pilot testing bias measure

To be able to conduct an RTC using the BdB-app as an instrument to measure bias towards alcohol, more validation and pilot testing is needed. Unfortunately, it seemed not all data from bias measurements were saved in the log-data, this resulted in vast data loss. Moreover, of the tasks 40% was declared invalid, as a result of the predetermined cut-off for tasks with 25% error trails and/or extreme latencies. In the studies done by Greenwald et al., (2003) evaluating the Implicit Association Test, the percentages of errors and fast RT were considerably lower in their samples. Respectively ten percent of the participants would be eliminated with a cut off of 17,5% error trails in a task. A little over one percent of the participants was eliminated when using a 10 % cut off per task for RT under 300 milliseconds. The sample group of this study shows difficulties completing bias measurement sessions, in particular completing trails in <2000 milliseconds. This is in line with the findings of van Duijvenbode et al., (2017b), who found slower overall RT while using a joystick during AAT and also more fluctuations of RT within a task compared to the general population. Using a joystick or swiping on a smartphone require different motor skills, which can lead to different results. If using a

smartphone for AAT measurements might be beneficial for individuals with MBID, has to be examined further.

The observed change in bias of both participants who completed a pre-test and post-test bias measurement, is considered to be extreme in comparison to other studies using CBM (Eberl et al., 2013; Lindgren et al., 2015; Sharbanee et al., 2014). As the change in bias is observed from two participants no conclusions can derived of these results. As mentioned in the introduction, bias measurement via the BdB-app has not been validated thus far (Balci, 2019; Brouwer, 2019; Verhoeven, 2021). Due to the lack of data during this study it seems premature to recommend using the BdB-app as the solitary tool to measure cognitive bias towards alcohol. More research is required to validate this measure.

4.3 Strengths and Limitations

This study has several strengths and limitations. The data-triangulation in this study helps to reach a deeper and more comprehensive depiction of the acceptability and usability of the BdB-app by individuals with MBID. Qualitative data is supplemented with quantitative data, which lead to a deeper understanding of variables influencing the acceptability and usability of the BdB-app for individuals with MBID. Data-triangulation gave additional insight in for example, adherence to the training schedule and the alcohol intake of participants. In addition, data-triangulation offered understanding of the experience of participants in combination with their level of smartphone usage. An additional strength of the study is the familiarity of the researcher with individuals with MBID, as this benefits the contact between participants and researcher throughout the study.

Moreover, nine participants are distributed over three groups, with two groups consisting of merely two participants. Because of the low number of participants following a seven-day schedule (N=7), results regarding adherence to the schedule need to be interpreted with caution and with the notation that additional research in needed. On the contrary, this study provides a first insight in how individuals with MBID use and experience the BdB-app. Results and expertise gained from the current study can be utilized in future research towards user experience and effectiveness of the BdB-app.

As was discussed before, there was a loss of data, probably because of software malfunction. Considering the already small sample size of this study, limited data was left to analyse. Of the already limited data on cognitive biases, four sessions were deemed unfit for analysis because of the 25% error cut-off. In hindsight this error score is rigorous for bias measurements completed by individuals with MBID, because they have shown to have higher RTs compared to the general population. This indicates that an allowance of maximal 35% errors would be more fitting to this group. With this knowledge, results regarding the cognitive bias measurement and log-data have to be viewed for what they are, a first attempt to test the BdB-app for individuals with MBID. However, the results can be used examine this technical problem. For example, it is unclear whether the data was lost because of

technical malfunctioning, participants neglecting to adhere to the training schedule, or due to some human error while using the app. Also, it is recommended to use a cut-off percentage of 35% in the next study, this will allow more for more data to be analysed. Before a study with a bigger sample size, like an RCT, can be conducted beforementioned questions should be answered.

4.4 Recommendations

Based on results of this study recommendations can be given about the development of the BdB-app, the utilization of the BdB-app for individuals with MBID and suggestions for further research.

First, it is recommended to conduct additional research into the picture set, the optimal context of use, validation of measuring bias, user experience and usability testing. Conducting additional research will help design a version of the BdB-app that fits the needs of users with MBID, as well as creating more knowledge on the use of CBM interventions for individuals with MBID. Carrying out additional user tests will help designers create an app design fitting the standard of human-centred design. Also, participatory design can be taken into consideration (see: Gemert-Pijnen et al., 2018). In addition, participants of this study cannot be categorised as heavy drinkers. Therefore, it is interesting to see how the intended target group of the app utilizes the app and if effects on drinking behaviour are established by the app.

Based on the results of this study some adaptations to the BdB-app can be recommended, to alter the BdB-app to be more user-friendly for individuals with MBID. This entails increasing accessibility for individuals with reading impairments, improving navigation, improving the lay-out of different functionalities and adapting the picture set. As the results show it is important to consider vocabulary, the addition of a reading function that is able to read text aloud and the possibility to change font size. Additionally, results show a need to improve navigation, by substituting the home button for example. Furthermore, redesigning the lay-out of certain pages to accommodate the needs of individuals with MBID, like the page that allows users to personalize pictures used in training sessions. Lastly, it is important to study and validate the picture set used for this group and to subsequently adapt the picture set based on new information.

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Appendix A: Questionnaire

Start of Block: Demografische gegevens

Q1 Eerst vragen we naar uw persoonlijke gegevens.

Q2 Hoe identificeert u zich?

- ○ Man
- ○ Vrouw
- ○ Anders, namelijk... _____

Q3 Hoe oud bent u? (In jaren)

_____

Q4 Wat is uw belangrijkste dagbesteding?

- ○ Betaald werk
- ○ Vrijwilligerswerk
- ○ Studeren, naar school gaan of dagbesteding
- ○ Huishouding
- ○ Zorg voor kinderen plus huishouding
- ○ Sport en/of hobby
- ○ Geen
- ○ Anders, namelijk... _____

Q36 Hoe zou u uw woonsituatie het beste omschrijven?

- ○ Samen met een partner, huisgenoot of kinderen
- ○ Alleen
- ○ Thuis, bij ouders

Q37 Krijgt u hulp van een zorginstelling?

- ○ Nee, ik krijg geen zorg
- ○ Ja, Ik krijg zorg maar woon niet in een zorginstelling
- ○ Ja, ik woon binnen een zorginstelling

Q40 Heeft u al eens hulp gekregen van een instelling bij het stoppen met drinken?

	Klopt helemaal	Klopt meestal	Klopt een beetje	Klopt helemaal niet

Ik heb hulp gevraagd maar ben niet in behandeling geweest	○	○	○	○
Ik ben al eens een behandeling gestart om minder te drinken of te stoppen maar heb deze niet afgemaakt	○	○	○	○
Ik ben al eens een behandeling gestart om minder te drinken of te stoppen en heb deze ook afgemaakt	○	○	○	○
Ik heb nog nooit hulp gehad om te stoppen of te minderen met het drinken van alcohol	○	○	○	○

End of Block: Demografische gegevens

Start of Block: Block 4

Q38 Hieronder ziet u een aantal stellingen. Wilt u zo goed mogelijk aankruisen welke dingen invloed hebben op uw alcohol gebruik?

	Klopt helemaal	Klopt meestal	Klopt een beetje	Klopt helemaal niet
Ik heb genoeg mogelijkheden om alcohol te halen als ik dat wil	○	○	○	○
Ik heb weinig geld te besteden per week	○	○	○	○
Ik kan niet altijd naar de winkel als ik dat wil	○	○	○	○
Mijn woonvorm heeft regels over het drinken van alcohol	○	○	○	○
Ik gebruik medicatie die niet (goed) samen gaat met alcohol	○	○	○	○
Mijn woonvorm heeft regels over het doen van boodschappen	○	○	○	○

Q42 Vindt u zelf dat u te veel alcohol drinkt?

- ○ Nee, ik drink maar heel weinig
- ○ Nee, ik drink normaal
- ○ Ja, ik drink soms te veel
- ○ Ja, ik drink te veel

Q41 We willen graag weten of u wilt stoppen of minderen met drinken

	Jazeker	Ik denk het wel	Ik denk het niet	Zeker niet
Bent u van plan om te minderen met drinken?	○	○	○	○
Bent u van plan om te stoppen met drinken?	○	○	○	○

End of Block: Block 4

Start of Block: Smartphone gebruik

Q6 Er volgen nu een aantal vragen over uw smartphone gebruik.

Q7 Ik lees mijn e-mail op mijn telefoon

- ○ Nooit
- ○ Eens per maand
- ○ Een paar keer per maand
- ○ Een keer per week
- ○ Een paar keer per week
- ○ Een keer per dag
- ○ Een paar keer per dag
- ○ Een keer per uur
- ○ Een paar keer per uur
- ○ De hele tijd

Q8 Ik gebruik mijn telefoon voor het vinden van de weg (bijvoorbeeld Google maps)

- ○ Nooit
- ○ Eens per maand
- ○ Een paar keer per maand
- ○ Een keer per week
- ○ Een paar keer per week
- ○ Een keer per dag
- ○ Een paar keer per dag

- ○ Een keer per uur
- ○ Een paar keer per uur
- ○ De hele tijd

Q9 Ik gebruik mijn telefoon om op websites te kijken

- ○ Nooit
- ○ Eens per maand
- ○ Een paar keer per maand
- ○ Een keer per week
- ○ Een paar keer per week
- ○ Een keer per dag
- ○ Een paar keer per dag
- ○ Een keer per uur
- ○ Een paar keer per uur
- ○ De hele tijd

Q10 Ik luister naar muziek op mijn telefoon

- ○ Nooit
- ○ Eens per maand
- ○ Een paar keer per maand
- ○ Een keer per week
- ○ Een paar keer per week
- ○ Een keer per dag
- ○ Een paar keer per dag
- ○ Een keer per uur
- ○ Een paar keer per uur
- ○ De hele tijd

Q11 Ik maak foto's met mijn telefoon

- ○ Nooit
- ○ Eens per maand
- ○ Een paar keer per maand
- ○ Een keer per week
- ○ Een paar keer per week
- ○ Een keer per dag
- ○ Een paar keer per dag
- ○ Een keer per uur
- ○ Een paar keer per uur
- ○ De hele tijd

Q12 Ik bekijk het nieuws op mijn telefoon

- ○ Nooit
- ○ Eens per maand
- ○ Een paar keer per maand
- ○ Een keer per week
- ○ Een paar keer per week
- ○ Een keer per dag
- ○ Een paar keer per dag
- ○ Een keer per uur
- ○ Een paar keer per uur
- ○ De hele tijd

Q13 Ik neem video's op, op mijn telefoon

- ○ Nooit
- ○ Eens per maand
- ○ Een paar keer per maand
- ○ Een keer per week
- ○ Een paar keer per week
- ○ Een keer per dag
- ○ Een paar keer per dag
- ○ Een keer per uur
- ○ Een paar keer per uur
- ○ De hele tijd

Q14 Ik gebruik apps op mijn telefoon

- ○ Nooit
- ○ Eens per maand
- ○ Een paar keer per maand
- ○ Een keer per week
- ○ Een paar keer per week
- ○ Een keer per dag
- ○ Een paar keer per dag
- ○ Een keer per uur
- ○ Een paar keer per uur
- ○ De hele tijd

Q15 Ik gebruik mijn telefoon om dingen op te zoeken die ik wil weten

- ○ Nooit
- ○ Eens per maand
- ○ Een paar keer per maand
- ○ Een keer per week
- ○ Een paar keer per week
- ○ Een keer per dag
- ○ Een paar keer per dag
- ○ Een keer per uur
- ○ Een paar keer per uur
- ○ De hele tijd

End of Block: Smartphone gebruik

Start of Block: TLFB

Q18 **Nu willen we u een aantal vragen stellen over hoeveel glazen alcohol u per week drinkt. Een blikje bier telt ook als een glas. Dit geldt ook voor blikjes met andere alcoholische (mix) drank.**

Dag 1 is dan gisteren, dag 2 eergisteren, enzovoort. Pak eventueel uw agenda erbij, begin bij gisteren (dag 1) en werk zo terug. Als het vandaag bijvoorbeeld woensdag is, dan gaat dag 1 over gisteren (dinsdag), dag 2 over eergisteren (maandag), en is dag 7 dezelfde dag als vandaag (woensdag).

Q20 Geef alstublieft aan hoeveel glazen alcohol u gisteren (dag 1) heeft gedronken. Glazen alcohol:

_____

Q22 En eergisteren (dag 2)? Glazen alcohol:

_____

Q24 En die dag ervoor (dag 3)? Glazen alcohol:

_____

Q26 En die dag ervoor (dag 4)? Glazen alcohol:

_____

Q28 En die dag ervoor (dag 5)? Glazen alcohol:

_____

Q30 En die dag ervoor (dag 6)? Glazen alcohol:

_____

Q32 En die dag ervoor (dag 7, een week geleden)? Glazen alcohol:

_____

End of Block: TLFB

Start of Block: AUDIT

Q38 **Er volgen nu een aantal vragen over uw gebruik van alcoholische dranken zoals bier, wijn, jenever en dergelijke in het afgelopen jaar.** Klik het bolletje aan bij de tekst die het meest lijkt op uw antwoord op de vraag.

Q40 Hoe vaak drinkt u alcohol?

- ○ Nooit
- ○ 1 keer per maand of minder
- ○ 2 tot 4 keer per maand
- ○ 2 tot 3 keer per week
- ○ 4 of meer keer per week

Q42 Op een dag waarop u alcohol drinkt, hoeveel glazen drinkt u dan gewoonlijk?

- ○ 1 of 2
- ○ 3 of 4
- ○ 5 of 6
- ○ 7 tot 9
- ○ 10 of meer

Q44 Hoe vaak zijn er gelegenheden waarop u 6 of meer glazen alcohol drinkt? In het afgelopen jaar.

- ○ Nooit
- ○ Minder dan 1 keer per maand
- ○ Maandelijks
- ○ Wekelijks
- ○ Dagelijks of bijna dagelijks

Q46 Hoe vaak heeft u het afgelopen jaar gemerkt dat u niet meer kon stoppen met drinken als u eenmaal begonnen was?

- ○ Nooit
- ○ Minder dan 1 keer per maand
- ○ Maandelijks
- ○ Wekelijks
- ○ Dagelijks of bijna dagelijks

Q48 Hoe vaak was u in het afgelopen jaar vanwege drankgebruik niet in staat om de dingen te doen die normaal van u verwacht worden?

- ○ Nooit
- ○ Minder dan 1 keer per maand
- ○ Maandelijks
- ○ Wekelijks
- ○ Dagelijks of bijna dagelijks

Q50 Hoe vaak heeft u het afgelopen jaar ‘s ochtends alcohol nodig gehad om weer op gang te komen nadat u veel had gedronken?

- ○ Nooit
- ○ Minder dan 1 keer per maand
- ○ Maandelijks
- ○ Wekelijks
- ○ Dagelijks of bijna dagelijks

Q52 Hoe vaak heeft u zich het afgelopen jaar schuldig gevoeld of spijt gehad nadat u gedronken had?

- ○ Nooit
- ○ Minder dan 1 keer per maand
- ○ Maandelijks
- ○ Wekelijks
- ○ Dagelijks of bijna dagelijks

Q54 Hoe vaak kon u zich het afgelopen jaar niet herinneren wat de vorige avond gebeurd was doordat u gedronken had?

- ○ Nooit
- ○ Minder dan 1 keer per maand
- ○ Maandelijks
- ○ Wekelijks
- ○ Dagelijks of bijna dagelijks

Q56 Bent uzelf, of is iemand anders ooit gewond geraakt doordat u gedronken had?

- ○ Nee
- ○ Ja, maar niet in het afgelopen jaar
- ○ Ja, in het afgelopen jaar

Q58 Heeft een familielid, een vriend, een dokter of een andere hulpverlener zich ooit zorgen gemaakt over uw drankgebruik of u aangeraden om minder te drinken?

- ○ Nee
- ○ Ja, maar niet in het afgelopen jaar
- ○ Ja, in het afgelopen jaar

End of Block: AUDIT

Appendix B: Original Smartphone Usage Subscale

Original items of the Smartphone Usage Subscale of the Media and Technology Usage and Attitudes Scale

Scoring: 10-point frequency scale:

Never (1)

Once a month (2)

Several times a month (3)

Once a week (4)

Several times a week (5)

Once a day (6)

Several times a day (7)

Once an hour (8)

Several times an hour (9)

All the time (10)

Questions:

1. Read e-mail on a mobile phone.
2. Get directions or use GPS on a mobile phone.
3. Browse the web on a mobile phone.
4. Listen to music on a mobile phone.
5. Take pictures using a mobile phone.
6. Check the news on a mobile phone.
7. Record video on a mobile phone.
8. Use apps (for any purpose) on a mobile phone.
9. Search for information with a mobile phone.

Appendix C: Codebook

Topic/Theme	Explanation	Code	Explanation
Installation of app	What help was needed or wanted during the installation of the app? How was downloading perceived by participants? How was the installation, e.g. selecting pictures, creating an account, perceived by participants	**Missing alcohol**	Participant talks about alcohol that he/she is familiar with that is not included.
		Creating account	Participants talked about creating an account or is setting up the account.
		Downloading in Play Store	Participant is, or talks about, downloading app from the Play Store.
		Selecting pictures	Participant is, or talks about, selecting pictures in app.
(Technical) Support	Are there instances where a participant needed (technical) support to use the app? What kind of support was asked? E.g. not understanding text, trouble navigating in the app. Who did participants ask for help? Would they like additional support in the future?	**Caregivers**	Participants talk about asking or receiving help from caregivers. Or they talk about *not* needing help from caregivers.
		Text	Participant talks about (difficulties) understanding text. And needing others to understand text in the app.
		Researcher	Participants talks about, or receives, help from researcher.
		Help Others	Participant talks about needing or receiving help from unspecified others.

Reminders	Did participants receive reminders from the app? Did participants set up external reminders? What reminded participants to do sessions?	**In-app reminders**	Participants talks about receiving in-app reminders.
		External Reminders	Participants talk about using or setting up external reminders.
		Cues	Participants talk about cues that reminded to do the training.
Ease of use/ Burden of use	Sessions are seen as a burden on daily life, or the opposite. Do participants perceive difficulty implementing sessions into their daily routine. Ease of navigation in the app. Possible features of app that increases the level of difficulty of the app.	**Unobtrusive**	Participants describe app as unobtrusive in their daily life.
		Obtrusive	Participants describe the app as obtrusive or a burden in their daily life.
		Daily Routine	Participants talk about implementing the app in their daily life.
		Navigation	Participants talk about, or show, in-app navigation.
		Features	Participant talks about different features of the app.
		Usability	Participant talks about, or shows, existing app features that influence the usability of the app.
		Technical problems	Participant talks about, or shows, technical difficulties in app.
Context of use	In what context is the app used. Which time of day was preferred	**Environment**	Participant describes context of use, e.g. living room, bedroom,

	for completing training sessions? What are distractions in the context while using the app? Helping contextual cues during training sessions.		at work, and setting e.g. being alone, being in a busy place.
		Time of day	Participant describes the time of day the training sessions were completed.
		Distractions	Participant describe distractions in their environment that influenced completion of training sessions.
		~~**Helping factors**~~	~~Participants describe helping factors in their context of use.~~
Adherence	How do participants describe their adherence, the helping and hindering of adherence? Also, the perceived ease of adherence to the training schedule.	**Number of training sessions**	Participant talk about, or show, the number of sessions completed.
		Helping adherence	Participant describe what helped adherence to the training schedule.
		Hindering adherence	Participant describe what hindered adhering to the training schedule.
		Perceived ease of adherence	Participants describe the perceived ease of adhering to the training schedule.
Perceived efficacy	Do participants describe a decrease in alcohol intake? What do participants describe as the	**Alcohol intake**	Participants describe if, and how, doing training sessions has influenced their alcohol intake.

	working mechanism of the app? Are participants inclined to use the app in the future? Are participants willing to use the app when quitting alcohol?	**Working mechanism**	Participants describe the perceived working mechanism of the app.
		Future use	Participants talk about (not) using the app in the future.
Points of improvement	What points of improvement do participants mention?	**Point of improvement**	Participants talks about point of improvement of the application or the training schedule.
Other	Other important quotes that mentioned in the interview that don't fit in other categories.	**Other**	Other important quotes that mentioned in the interview that don't fit in other categories.
Opinion	Participants share their general opinion about the app.		