Patients' Experiences of Using a Cellular Photo Digital Breathalyzer for Treatment Purposes

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Objectives: The field of eHealth systems is rapidly developing and is now expanding into alcohol treatment settings. Despite a growing public and professional interest, cellular photo digital breathalyzers (CPDBs) have not been investigated in a clinical context so far. In this study, we aimed to investigate the experiences of patients in alcohol treatment who had been using a CPDB—TripleA- for a minimum of three months. What are their personal experiences of using the CPDB? Do the patients think it supports them to change their drinking habits, and if so, in what way?

Methods: A qualitative interview study with individuals who had been using the CPDB TripleA, for at least 3 months as complement to treatment (12-step program or hospital-based outpatient care). A thematic analysis with an inductive approach was used to identify, analyze, and interpret patterns within data.

Results: In all, 12 interviews were conducted with 8 men and 4 women. Participants were generally enthusiastic about the CPDB and found it convenient and useful, even though it created a need for privacy when using the device. Although technical problems were substantial, participants were tolerant to those. The system was perceived to support self-control and to restore relations, but did not replace the need for close contact with caregivers. Self-motivation to change drinking habits was essential, and could not be reached by solely using the CPDB.

Conclusions: Participants perceived the CPDB as a convenient and useful tool that was supportive under the circumstances that it was used in a context that included personal contact with a caregiver; and the user felt more than just a minimum of motivation to reduce drinking. Technical stability needs to be achieved to secure long-term use.

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Monitoring of alcohol consumption is of substantial value for several purposes—for epidemiological and treatment research, for surveillance of alcohol offenders, and as a component of voluntary alcohol treatment. As part of the rapidly growing field of eHealth services, portable electronic devices for the monitoring of alcohol use are now becoming publicly available. Progress in electronic engineering has provided technologies such as interactive voice response (IVR) and transdermal alcohol sensors (TDS) for the monitoring of alcohol use. In the past few years, cellular photo digital breathalyzers (CPDBs) have come into use (Skipper et al., 2014; Gordon et al., 2017). A CPDB measures real-time blood alcohol content (BAC) and communicates results immediately via a cell phone's Bluetooth to the patient, and also to the caregiver on a monitoring web site. For identification purposes, a facial photo or filmed sequence was taken mid-exhalation.

Traditionally, data on alcohol use for research and clinical purposes have been collected with the use of self-report questionnaires. Several questionnaires are well-established and considered reliable, among which Time-Line Follow-Back (TLFB) and Alcohol Use Disorders Identification Test (AUDIT) are the most renowned (Sobell and Sobell, 1992; Saunders et al., 1993). However, self-report data (especially on alcohol use) always carry the risk that the individual does not adequately report the consumption, for social desirability reasons or due to recall bias.

Interactive voice response (IVR) is a cell phone-administered self-report questionnaire that can be used to monitor alcohol use. Participants receive previously recorded messages and report information about their drinking through their phone's voice response technology or touch tone keypad (Gurvich et al., 2013). Advantages and disadvantages are similar to those of paper-based questionnaires—they may be useful for research and treatment purposes, but carry an intrinsic risk for inadequate reporting and recall bias.

Another form for collecting alcohol use data and for surveillance is Transdermal Sensors (TDS). A TDS measures alcohol levels through perspiration, that is, ethanol gas at the skin surface using a fuel-cell sensor (Marques and McKnight, 2009; Dougherty et al., 2012; Leffingwell et al., 2013; Neville

et al., 2013; Dougherty et al., 2015; Roache et al., 2015). The TDS reports continuously to a remote server with a delay of between 30 and 120 minutes depending on the measured person's metabolism (Gurvich et al., 2013). Transdermal sensors were developed for criminal justice settings to be worn as anklets or bracelets by court-referred alcohol offenders 24 hours a day, 7 days a week, for up to several months. So far, studies reporting the use of TDS only in a voluntary treatment setting are scarce (Barnett, 2014; Dougherty et al., 2014).

In voluntary treatment settings, TDS, and also traditional breathalyzers, have been tested in combination with contingency management (CM) to reinforce abstinence, with promising results (Barnett et al., 2011; Alessi and Petry, 2013; Barnett et al., 2017). The IVR has mostly been used as a lower-intensity alcohol intervention among students (Berman et al., 2016) and untreated adults (Simpson et al., 2012), with mixed results.

The CPDB systems are available from several producers. The system tested in this study—TripleA—was developed by a Swedish company (Kontigocare, Uppsala, Sweden). Although originally intended as an alternative method to monitor periods with high risk of relapse after 12-step residential programs, the TripleA also has a potential to serve as a complement to traditional outpatient alcohol treatment. A research project including a randomized controlled trial (RCT) to test the efficacy of TripleA to reduce drinking was initiated in 2015 in Uppsala, Sweden. The primary aim of the RCT is to investigate differences in alcohol consumption among alcohol-dependent persons who receive conventional treatment only and those who receive conventional treatment completed with TripleA. The main effects will be measured as the difference between treatment arms in the proportion of patients with heavy drinking days, number of heavy drinking days, and the difference in total amount of alcohol consumed. A number of secondary effects will be measured, for example, changes in drinking patterns, treatment fidelity, and self-perceived health outcome. Along with the CPDB, questionnaires, and also biomarkers, will be used for outcome comparisons. This qualitative interview study is the first report from the project. The RCT will be reported in near time.

The CPDB systems have been sparsely investigated and so far not in a clinical context (Skipper et al., 2014). When introducing a new form of intervention, not only quantifiable effects are of importance (Malterud, 2001). Qualitative research can contribute to a broader understanding of what makes the intervention helpful or not to the person using it. In this study, we used a qualitative method to investigate the experiences of those patients who had been using a CPDB for a period of at least 3 months. What are their personal experiences of using the system? Do the patients think it supports them to change their drinking habits and if so, in what way?

METHODS

The TripleA System

The TripleA system consists of a wireless breathalyzer, an application for a cell phone, and a health care portal. The patient receives a reminder on the phone via the portal when it is time to perform a test. He/she then uses the video camera of the phone to verify that the right person is performing the test. The result of the test, the estimated blood alcohol content, is immediately communicated to the patient and presented as a green (happy) face, a red (sad) face, or with a message that alcohol could be traced and that the test should be re-performed within 15 minutes. The result is also sent in real time to the portal and is available for the caregiver. The incidence and timing of the test is set as preferred by the patient, normally 2 to 4 times per day. Although it is technically possible to calibrate the device to detect alcohol at different levels to separate participants with different drinking goals, further elaboration of that procedure remains.

Setting and Participants

Participants in this interview study were recruited from the TripleA study. Inclusion criteria for that study were as follows: 18 years or older, minimum 2 DSM-5 criteria for alcohol use disorder, adequate knowledge of Swedish language, and a stable housing for night rest and for charging the cell phone. Exclusion criteria were: diagnosed with schizophrenia, ongoing substance use disorder except for alcohol and nicotine, under coercive treatment. An additional inclusion criterion for this interview study was having used the TripleA for a minimum of 3 months. Patient recruitment took place at either the outpatient addiction treatment center at Uppsala University Hospital, Sweden; or the aftercare unit of a private 12-step treatment facility, Nämndemansgården in Uppsala. At the hospital-based addiction treatment center, pharmacotherapy is used alone or in combination with counseling based on the principles of cognitive-behavioral therapy (CBT) and motivational interviewing (MI). Breathalyzing and blood samples are commonly used for biofeedback. The patient's goal may be controlled drinking or total abstinence. The 12-step treatment facility offers a 5-week residential treatment with an aftercare period of 12 months. The treatment program builds on the principles of alcoholics anonymous (AA), in which the first step is to admit powerlessness over the alcohol. The program has been modified for Swedish conditions, and the facility declares that treatment is adjusted to the single person to reach ''freedom from addiction'' (Nämndemansgården, 2017). Medical staff is available, but serve as a complement to the 12-step treatment. Both sites represent typical Swedish addiction treatment forms.

During the recruitment period for this study, 39 individuals were randomized to receive the TripleA. Of those, 58% were men and 42% were women. Ages ranged from 39 to 69 years; mean age ± SD was 54.6 (±7.6), median 54 years. Their mean AUDIT score at inclusion ± SD was 25.7 (±6.4). Almost two-third were occupied or studying. Of those randomized to the intervention arm, 23 (59%) were participating in the study and using the device. Sixteen patients who had been randomized to receive the TripleA had terminated their participation in the study shortly after randomization. The majority of those (n = 9) never came to use the device regularly, because they resumed their heavy drinking shortly after accepting to participate. Others left the study early because they moved to other cities (n = 2), got somatically

severely ill (n = 1), tried to commit suicide (n = 1), because of cognitive deficits (n = 1) or due to amphetamine use (n = 1). One patient was impossible to reach by phone or mail.

For this interview study, patients who had been using the TripleA within the RCT for a minimum of 3 months were selected, which excluded another 11 participants who had less than 3 months' experience of the device. Other inclusion/exclusion criteria were the same as in the RCT. After having received written information, patients were asked to contact the research nurses if they were willing to participate. Two of the participants were recruited this way, and the others were consecutively approached at their next regular visit to the clinic/treatment facility. When asked by one of the nurses, the vast majority was interested in taking part; only 1 of the approached declined. After detailed oral and written information, a signed written consent was received from each participant.

Of the 12 individuals included, 8 were men and 4 were women, aged 45 to 68 years. Nine of the participants were recruited from the hospital clinic and 3 from the 12-step treatment facility. For 9 of the participants, total abstinence was the goal, whereas 3 aimed for controlled drinking.

The project was approved by the Regional Ethical Review Board of Uppsala (Reg. no. 2015/297).

Data Collection

Participants were offered to choose location for the interview; all interview sessions took place at the researchers' office except for 2—one in a patient's home and one at a café. At the interview session, participants were given an open question; they were asked to share their experiences of using the TripleA. In addition, all participants were asked if the TripleA had helped them to drink less and if so, in what way. Prompting questions were used to explore informant's perceptions and experiences in more depth. All sessions were recorded with MP3-players and transcribed verbatim.

Data Analysis

To analyze the interview data, a qualitative method—thematic analysis (Braun and Clarke, 2006)—was used. Themes were identified and analyzed inductively, that is, themes were formed from data only and not from predetermined areas of interest.

The transcripts were read several times by authors CN and KC separately. Meaning units—words and sentences of interest for the aims of the study—were coded. After a joint discussion, codes were sorted into preliminary themes. The material was re-read by both authors CN and KC, and themes were reviewed and subthemes were created. The analysis continued until all themes were deemed to be clearly defined and distinct from one another. All authors (CN, KC, and CÖ) discussed the coding of data until consensus was achieved, and themes were perceived as describing the content concisely. In addition to being researchers, all authors have extensive experience in the field of psychiatric care and/or substance use treatment.

RESULTS

Once 12 interviews had been conducted, information from the last ones did not produce any changes to the codes and we deemed saturation to be reached (Guest et al., 2006). The interview sessions were 11:16 to 39:02 minutes long, with a median length of 26:49 minutes. All interviews were included in the analysis. The results are presented below under the 3 identified themes—practical experiences, control, and motivation is essential—and pertaining subthemes. Verbatim quotes are used and selected to illuminate ways of thinking and the linkages individuals made for themselves.

Practical Experiences

Technical Issues

Almost all participants described technical problems as part of their experience, some minor and some of more critical character. Mainly, participants were tolerant to the technical problems and accepted them as a developmental issue. But for some, technical problems became a reason for not using the TripleA as planned.

"When I went on holiday, it didn't work at all. I went to another time zone and it didn't work at all. (. . .) And there's been other times too. And I told [the nurse] that now, I don't want to be part of this anymore." (Interview #2).

A Convenient and Useful Tool

Generally, participants perceived that using the technique was simple and convenient. It was described as an easy way to keep track on themselves in their ambition to reduce drinking.

"On the whole, if you're to blow, in practical terms this is considerably simpler than coming here [to the clinic]." (Interview #7)

"I could decide for my own when to blow and so on. So, that was nothing that felt intrusive. I haven't in any way felt that it was inflicting on my life, it's just been problem-free for me to use it. And it's just fun. . . I have a [pet] who accompanies me when I blow and she gets happy when the phone lights up. "(Interview #8).

Avoiding Public Exposure

Participants did not want to expose themselves to others while using the device, which created a certain need for caution.

"It can be complicated when you're sort of socially tied up in some way. If you're at a concert. . .and. . .I was recently teaching at a university course where I was continuously sitting with students in modules of 3–4 hours. And then you have to remember to turn that thing off. "(Interview #3)

"When I'm out driving a bus I don't sit there and blow in front of the passengers. They may get a lot of funny ideas." (Interview #1)

"In the beginning I felt a bit panicked when I was away on jobs and so on. Because I meet a lot of people. I was at a job where I couldn't get away, so I had to go to the lavatory. But one can sort of hear it when you're in there blowing, the walls are thin." (Interview #5).

Still, most participants had found a manner of dealing with privacy issues and it was mainly not considered a problem. Two informants had chosen to be totally open about their giving the tests and had not had any negative reactions to that approach.

Control

The concept of control is crucial in the monitoring of alcohol use. Control could be presented by the participants as a support to an internal process or as a response to expectations from others, but control was in both cases described in positive terms, helping them to hold on to their own ambitions.

Self-control

The monitoring system was mainly referred to in general terms as an incentive, a support or a reminder that strengthened one's self-control.

"It think it can serve as a reminder to reconsider, once more. Before, it all used to start with me going out with people, after work or so. And me thinking I might have a beer or so. And that's not a very good idea for me, in the long run." (Interview #7)

"It's sort of a spur for me to get that green face three times a day. It's really important." (Interview #4)

It could also help preventing or stopping a period of relapse, which was reported by 3 participants.

"In January, I had a minor relapse. And then the phone started beeping or tinging. So I understood I had really messed things up. So in fact, I called up [my caregiver] and also my probation officer and told them 'This is how things are'. They will notice it anyway. And then I finished that [drinking] off and gave a test the morning after. And I don't think I would have done that without the device." (Interview #5)

"There was an occasion this autumn when I nearly started drinking again but I thought: No, I am blowing tonight and. . .No, I refrain from that. So that time, it saved me from a relapse, you can say." (Interview #4)

Others' Expectations

Expectations from others played an important role in encouraging the participants to reduce drinking. To restore confidence in family relations could be a driving force.

"I can only see benefits. Now that treatment is over, I want to keep my close ones calm, my family and so on. (. . .) My wife, she is not at all worried to go to work on Saturdays now, she knows I blow. And my daughter, she's nine, she thinks it is really nice." (Interview #4)

Caregivers and their expectations were also important.

"Sometimes when I film myself I spoof with [name of nurse], I think she ought to get some fun too. I put on a hat or so.(. . .) I've had really nice contacts here at the clinic." (Interview #1)

"And you're supposed to sort of report. . . when I meet my caregiver it's a social process where you sit with a person and: 'Let's see how we're doing'. (. . .) And it feels a bit ridiculous to be in a treatment if you don't make an effort and try." (Interview #3)

For some, it was important to be able to present proof that they were sober.

"I really think it has helped me. I have it on paper that I am sober. And that I have been for so and so long. (. . .) And when I come in to [somatic ward] here, they can see, too, how long I have been sober." (Interview #9)

"I can prove I am 100% sober, so I am welcome to that relapse prevention group today." (Interview #12)

Motivation is Essential

Participants talked about own motivation as central – without motivation, neither monitoring nor other efforts were likely to reduce drinking.

"I do this because I want to. I don't want to drink. And if you have that desire not to drink, you don't want to blow red. It goes against your self-esteem so to say. I'm proud I don't fall into it [drinking]." (Interview #8)

"It's a sort of boost for me, but it is not TripleA that keeps me sober. It's the Antabuse right now, to be frank. But fact is I have made up my mind. And this TripleA helps me." (Interview #12)

"This blowing itself hasn't prevented me from drinking. If you're not motivated to quit you don't quit. It doesn't matter how you try to persuade such a person." (Interview #9)

Motivation to change drinking habits was explicitly low in two of the participants and they did not find the monitoring supportive.

"I blow just because I have been ordered to. (. . .) I drink anyway, and then I just don't blow. I know I'm supposed to give it a thought but I don't really do that." (Interview #6)

"Of course it feels good when you blow clean. And I thought about it [the device] but I couldn't hold myself back." (Interview #10)

Both communicated they had emotional problems that made it difficult for them also to deal with their alcohol problems at this time. These 2 participants also described the system in negative terms as insufficient and carrying a lot of technical problems.

DISCUSSION

Technical development of eHealth systems is rapid and is now spreading to addiction treatment settings, making it even more important to investigate users' appreciations of their value. Previous studies of remote BAC monitoring

systems have mainly studied the technical performance of the different devices (Marques and McKnight, 2009; Dougherty et al., 2012; Skipper et al., 2014) or the device as a complement to CM (Barnett et al., 2011; Dougherty et al., 2014; Barnett et al., 2017). Although results are promising, treatment efficacy studies in larger samples and different settings are still highly needed (Gordon et al., 2017). Efficacy for persons aiming at controlled drinking rather than total abstinence is of special interest, since controlled drinking is a common goal for persons with drinking problems (DeMartini et al., 2014).

Reports on users' experiences of using remote BAC monitoring systems are scarce. One recent study of TDS, in which participants mainly responded to fixed items, found that most users appreciated the device and perceived that it helped them reduce their drinking (Alessi et al., 2017). This is the first study to use a qualitative method to investigate the experiences of patients using a remote BAC monitoring system. Similar to those using the TDS, participants were largely enthusiastic about the CPDB, but important conditions were noted. The system was perceived as a convenient and useful tool that was supportive under the circumstances that it was in a context that included personal contact with a caregiver; and the user felt more than just a minimum of motivation to reduce drinking. The negative sides of the technology that were reported were few and mainly concerned integrity issues as reported in the theme ''Practical experiences,'' subtheme ''Avoiding public exposure.'' However, those integrity issues could be resolved quite easily; users found private places to give the test or postponed their testing. Technical shortcomings were substantial, but the participants expressed tolerance to such disturbances. It is possible that the technical problems reported are just a sign of immature technical development and will be adjusted over time. Although participants in this study were generally enthusiastic about the device and thus understanding towards these problems, they may lose patience over time if problems continue.

Treatment programs for alcohol problems are generally limited in time. The CPDB was described by participants as a way of prolonging treatment in a positive way and with a minimum of negative impact on daily life. It could also serve as a way to regain trust from family members and significant others. Still, it did not replace the need for other supporting elements, but was rather described as a complement. It was obvious that for most participants, the CPDB could not replace personal contact with and feedback from the caregiver. Caregivers were mentioned in warm terms and many expressed a wish for more intense personal contact. Those who were more reluctant to personal contact described the CPDB as a complement to medication or to attending group meetings.

A CPDB is similar to a TDS in many aspects. Both devices monitor BAC remotely with good technical performance and both may serve well for surveillance purposes for persons who are willing and/or need to abstain from alcohol. In contrast to a TDS, a CPDB reports results immediately without time delay. The more important differences concern the testing procedure itself—a TDS—must be attached to an ankle or more rarely a wrist, and is worn continuously. Although most users found the TDS comfortable to wear, the device was reported to irritate the skin and keep the user from swimming and bathing, which was perceived a barrier to wearing it for a longer period of time (Alessi et al., 2017). Users also found it tiresome to explain the bracelet to others (Alessi et al., 2017). Similarly, participants in this study raised integrity concerns, but they also reported having found strategies to deal with those issues.

Rather than creating motivation to change drinking habits, the CPDB supported self-control. Lack of self-control, that is, impulsivity, is commonly found among persons with substance use disorders and is generally considered to be a risk factor for developing alcohol and drug disorders (Bornovalova et al., 2005; Reynolds et al., 2006; de Wit, 2009). But monitoring per se may be of less value. In a study where students were monitored with TDS, Neville et al found that just wearing the anklet did not change drinking behavior unless students, for the purpose of the study, were instructed not to drink (Neville et al., 2013). Participants in this study described their motivation to change drinking habits as an entity of its own, which was not immediately influenced by the monitoring system, but apparently stemmed from previous experiences. We draw the conclusion that CPDB and other remote monitoring BAC systems may serve as a support and a complement to other treatment for persons who have a desire to reduce drinking. Such a desire may not be persistent over time and it remains an important challenge for care providers to help individuals with alcohol problems locate and build their motivation to change. Motivational enhancement therapy (MET) is an example of a tool that can be used for such purposes (Sellman et al., 2001).

Strengths and Limitations

The major strength of this study is that it was performed in a clinical setting and with a qualitative method that allowed participants to express themselves in own words. Building on the experiences presented in this study, a questionnaire could be constructed to measure usability of CPDB with quantitative methods in which items could be formulated based on the themes presented. Only 1 of the approached declined to take part in the study, which indicates that participants may be regarded as representative to those who actually came to use the device. It may also imply that the subject of investigation was of interest for the participants.

On the contrary, the dropout rate of participants randomized to receive the TripleA was high at 3 months (41%). Although enthusiastic at start, the majority of those who dropped out resumed their heavy drinking without trying the TripleA. The option to use the device was obviously not perceived a sufficient support for the change of drinking habits. The technique is relatively new and it is possible that long-term use would produce different results. If further development of the device could reduce the technical problems described, it would possibly impact the users' experiences.

CONCLUSIONS

Participants perceived remote BAC monitoring with TripleA as a convenient and useful tool that was supportive

under the circumstances that it was used in a context that included personal contact with a caregiver; and the user felt more than just a minimum of motivation to reduce drinking. Technical stability needs to be achieved to secure long-term use.

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