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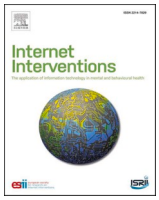

# App-based maintenance treatment for alcohol use disorder after acute inpatient treatment: Study protocol for a multicentre randomized controlled trial

Sebastian Saur [a,*], Kiona K. Weisel [a], Catharina Lang [a], Lukas M. Fuhrmann [a,d], Sabine Steins-Loeber [b], Niklas Enewoldsen [b], Daniela Reichl [b], Mathias Zink [c], Fabian Jakobi [c], Melanie Rudolph [c], Andreas Ahnert [d], Wolf-Dietrich Braunwarth [d], Peter Falkai [e], Gabriele Koller [e], Nina Behle [e], Laura Hager [e], Thomas Hillemacher [f], Peter Heepe [f], Felix-Nicolai Müller [f], Thomas Kraus [g], Yaroslav Kiderman [g], Nicola Horn [g], Johannes Kornhuber [h], Stephan Lins [h], Philipp Spitzer [h], Dominikus Bönsch [i], Cyril Counot [i], Mark Stemmler [j], Anja Hildebrand [j], Volker Amelung [k], Linda Kerkemeyer [k], Matthias Berking [a]

[a] Department of Clinical Psychology and Psychotherapy, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany
[b] Department of Clinical Psychology and Psychotherapy, Otto-Friedrich University Bamberg, Bamberg, Germany
[c] Department of Psychiatry, Psychotherapy and Psychosomatics, District Hospital Mittelfranken, Ansbach, Germany
[d] Department of Psychiatry, Addiction, Psychotherapy and Psychosomatics, District Hospital Mittelfranken, Erlangen, Germany
[e] Department of Psychiatry and Psychotherapy, LMU University Hospital Munich, Munich, Germany
[f] Department of Psychiatry and Psychotherapy, Paracelsus Medical University Nuremberg, Nuremberg, Germany
[g] Clinic for Psychiatry, Psychotherapy and Psychosomatics, District Hospital Mittelfranken, Engelthal, Germany
[h] Department of Psychiatry and Psychotherapy, University Hospital Erlangen, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany
[i] Department for Psychiatry, Psychotherapy and Psychosomatics, District Hospital Lohr, Lohr am Main, Germany
[j] Department of Psychological Assessment, Quantitative Methods and Forensic Psychology, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany
[k] inav — Institute for Applied Health Services Research, Berlin, Germany

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ABSTRACT

*Background:* Alcohol use disorder, a prevalent and disabling mental health problem, is often characterized by a chronic disease course. While effective inpatient and aftercare treatment options exist, the transferal of treatment success into everyday life is challenging and many patients remain without further assistance. App-based interventions with human guidance have great potential to support individuals after inpatient treatment, yet evidence on their efficacy remains scarce.

*Objectives:* To develop an app-based intervention with human guidance and evaluate its usability, efficacy, and cost-effectiveness.

*Methods:* Individuals with alcohol use disorder (DSM-5), aged 18 or higher, without history of schizophrenia, undergoing inpatient alcohol use disorder treatment (N = 356) were recruited in eight medical centres in Bavaria, Germany, between December 2019 and August 2021. Participants were randomized in a 1:1 ratio to either receive access to treatment as usual plus an app-based intervention with human guidance (intervention group) or access to treatment as usual plus app-based intervention after the active study phase (waitlist control/TAU group). Telephone-based assessments are conducted by diagnostic interviewers three and six weeks as well as three and six months after randomization. The primary outcome is the relapse risk during the six months after randomization assessed via the Timeline Follow-Back Interview. Secondary outcomes include intervention usage, uptake of aftercare treatments, AUD-related psychopathology, general psychopathology, and quality of life.

*Discussion:* This study will provide further insights into the use of app-based interventions with human guidance as maintenance treatment in individuals with AUD. If shown to be efficacious, the intervention may improve AUD treatment by assisting individuals in maintaining inpatient treatment success after returning into their

* Corresponding author at: Department of Clinical Psychology and Psychotherapy, Friedrich-Alexander University Erlangen-Nürnberg, Nägelsbachstraße 25a, Erlangen, Germany.
*E-mail address:* Sebastian.Saur@fau.de (S. Saur).

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home setting. Due to the ubiquitous use of smartphones, the intervention has the potential to become part of routine AUD care in Germany and countries with similar healthcare systems.

## 1. Introduction

Alcohol use disorder (AUD) is a widespread mental health problem with a 12-month prevalence rate estimated at 8.8% in Europe and 13.9% in the US (World Health Organization, 2018). Individuals with AUD often suffer from a chronic or recurring course of the disease (McKay and Hiller-Sturmhofel, 2011), a high disease burden (Rehm and Shield, 2019), stigmatization (Schomerus et al., 2011), reduced quality of life (Ugochukwu et al., 2013), lower health utility (Barbosa et al., 2021), a heightened risk for various physical and psychological comorbidities (Castillo-Carniglia et al., 2019; Gabriels et al., 2018; Schoepf and Heun, 2015), as well as an elevated mortality risk (Roerecke and Rehm, 2014). Through direct (e.g., treatment) and indirect costs (e.g., loss of productivity), AUD also imposes a significant monetary burden on societies worldwide (Mohapatra et al., 2010).

Fortunately, several pharmacological, psychological and behavioural approaches have been shown to be effective in the treatment of AUD (Witkiewitz et al., 2019). In more severe cases, inpatient treatment is recommended (Mann et al., 2017). However, the latter is associated with the challenge of transferring treatment outcomes from the protected clinic setting into everyday life. To help patients meet this challenge, many health care systems have established post-acute treatment options in rehabilitation clinics, counseling centres, or self-help groups. In particular, attending such aftercare treatments is recommended after the completion of inpatient treatment (Mann et al., 2017). However, in spite of the availability of aftercare treatments, many patients fail to use them, and are, hence, without support in a time associated with a high risk for relapse (Buchholz et al., 2019; Mojtabai et al., 2011).

To facilitate the utilization of aftercare treatments, app-based interventions can be assumed to have significant potential. Arguments for this hypothesis include the following: (1) app-based interventions reach patients even in those areas where face-to-face (f2f) support is scarce; (2) patients can work with the app at all times; (3) the lack of direct contact likely reduces stigma-associated barriers to treatment; (4) app-based interventions provide easy-to-use ways of communication between patients and healthcare professionals through text messages, chats, or telephone calls; (5) apps can provide information helpful for the transition in a cost-effective way; (6) app-based interventions can offer automated and therefore cost-effective trainings of abstinence skills; and (7) patients can be introduced into the app by clinic staff delivering the acute treatment. The latter implies that patients receive in-person support and encouragement to overcome technical and motivational barriers impeding app utilization. If patients, subsequently, receive support by a coach guiding the app, the period in which the patient is without support is completely eliminated.

Empirically, the hypothesis that digital interventions can help sustain inpatient treatment effects for AUD receives preliminary support from various studies showing that internet-based interventions are effective in the treatment of alcohol-related disorders (Boss et al., 2018; Johansson et al., 2021; Riper et al., 2018). With regard to app-based interventions against alcohol use, findings are more ambiguous (Colbert et al., 2020; Milne-Ives et al., 2020; Weisel et al., 2019). For individuals suffering from AUD, some studies found no significant effects (e.g., Mellentin et al., 2019), while other studies showed small to medium effect sizes of app-based interventions (e.g., Gustafson et al., 2014). Thus, there is a need to further improve the efficacy of app-based interventions against AUD.

It is of note that in previous studies, the amount of human support was limited - with studies using stand-alone interventions or only minimal human support. This appears to be problematic as it has been shown that the efficacy of app-based interventions increases when professional human guidance is provided (Linardon et al., 2019). Therefore, a promising way of improving the efficacy of app-based interventions against AUD is to include a significant amount of guidance.

A further potential problem can be hypothesized to result from the fact that indirect contact with a coach (through the app) has less motivational impact than direct human contact. Therefore, it can be hypothesized that app-based interventions for AUD should in particular work to motivate patients to participate in f2f-interventions. This should be especially important whenever a patient has completed inpatient treatment, is faced with the challenge of maintaining abstinence after returning home and would benefit from utilizing available f2f-aftercare treatments.

To the best of our knowledge, the efficacy of an app-based intervention with guidance for individuals suffering from AUD who have completed inpatient treatment that focuses in particular on engaging patients in available aftercare treatments has not yet been evaluated.

To bridge this gap, we aim to develop such an intervention and evaluate its usability, efficacy, and cost-effectiveness. For this purpose, we will conduct a randomized controlled trial in which the new intervention will be compared to a waitlist control/TAU group. We hypothesize that the intervention will 1) demonstrate good usability, 2) increase and prolong the uptake of aftercare treatments, 3) decrease the risk of relapse, and 4) be cost-effective. We also hypothesize that the assumed effects on promoting the utilization of aftercare treatments will mediate the effects of the intervention on relapse.

## 2. Methods

### 2.1. Study design

We will conduct a prospective, multicentre, two-arm, single-blinded, randomized controlled effectiveness trial. The study is registered at the German register of clinical trials (Deutsches Register für Klinische Studien, DRKS; registration number DRKS00017700), approved by the local ethics committee of the Friedrich-Alexander University Erlangen-Nürnberg (193_19 B), and will be conducted in accordance with the Declaration of Helsinki. The primary outcome will be the relapse risk after six months. Secondary outcomes will include intervention usage, uptake of aftercare treatments, AUD-related psychopathology, general psychopathology, and quality of life.

As indicated in Fig. 1, primary and secondary outcomes will be assessed at baseline (before randomization, T1), at post-intervention (six weeks after randomization, T3), at 3-month follow-up (three months after randomization, T4), and at 6-month follow-up (six months after randomization, T5) by diagnostic interviewers via telephone, while potential mediators will be assessed at mid-intervention (three weeks after randomization, T2). Diagnostic interviewers assessing the primary and secondary outcomes will be blind to group allocation, whereas participants and assessors of mediators and intervention-related outcomes will not be blind to study condition.

### 2.2. Participants and setting

Participants were recruited among individuals undergoing acute inpatient treatment (i.e., physical detoxification with varying degrees of support through pharmacological or short psychosocial interventions) in one of the eight participating medical centres (Bezirksklinikum Ansbach, Klinikum am Europakanal Erlangen, Krankenhaus Altdorf, Universitätsklinikum München, Frankenalb-Klinik Engelthal, Klinikum Nürnberg Nord, Universitätsklinikum Erlangen, Bezirkskrankenhaus Lohr am Main). Inclusion criteria are: 1) age $\geq$ 18 years, 2) a diagnosis of

AUD according to the Structured Clinical Interview for DSM-5 (SCID-5-CV), 3) a valid email address, 4) smartphone access with android version 5 or higher, and 5) provision of informed consent. Exclusion criteria are: 1) acute suicidality assessed by the respective item of the Patient Health Questionnaire (PHQ-9), 2) self-reported diagnosed schizophrenia or a psychosis lasting longer than 4 weeks (lifetime), 3) a prearranged, seamless transferal to an inpatient aftercare treatment (e.g., medical rehabilitation), 4) a legal resolution exceeding hospitalization, and 5) language or neurocognitive barriers.

### 2.3. Sample size calculation

We assume a relapse rate of 80% in the control group (Czapla et al., 2016) and an absolute risk reduction of 25% in the intervention group. Performing a power-analysis with STATA (Version 14.2) using a Cox Proportional Hazard model with alpha = 0.05 (95% confidence) and 80% power (20% beta), the required total sample size is N = 309. For telephone interviews in AUD patients, drop-out rates of 11% (Loeber et al., 2006) and 14% (Czapla et al., 2016) have been reported. Thus, we anticipated a drop-out rate of 13%. Compensating for this anticipated drop out led to a final sample size of N = 356 participants.

### 2.4. Procedures

#### 2.4.1. Recruitment

Study recruitment started in December 2019 and ended in August 2021. Psychologists and clinic staff in the medical centres were responsible for recruitment and screening. After declaring their interest in the study, potential participants were informed about the study procedures, extensively briefed about the purpose and course of the study, provided with written information on the study as well as the informed consent form and screened for meeting inclusion (and not meeting exclusion) criteria.

#### 2.4.2. Randomization

Eligible participants first completed the baseline assessment. Then they were randomly assigned to the control or intervention group. For the randomization procedure, we used a web-generated randomization list (https://www.sealedenvelope.com/simple-randomiser/v1/lists) across medical centres with a 1:1 ratio and a block size of four. Randomization was exclusively conducted by the Otto-Friedrich University Bamberg as the external, independent evaluator of the study that is not involved in any other part of the study. To maximize internal validity, recruiting psychologists in the medical centres were not informed about allocation sequence.

### 2.5. Study interventions

#### 2.5.1. App-based maintenance intervention

Participants in this group have access to treatment as usual as well as the app-based intervention with guidance (i.e., coaching via app and telephone, see below) developed for this study. The intervention phase with app intervention and human guidance lasts six weeks after inpatient treatment. After the intervention phase, participants have access to

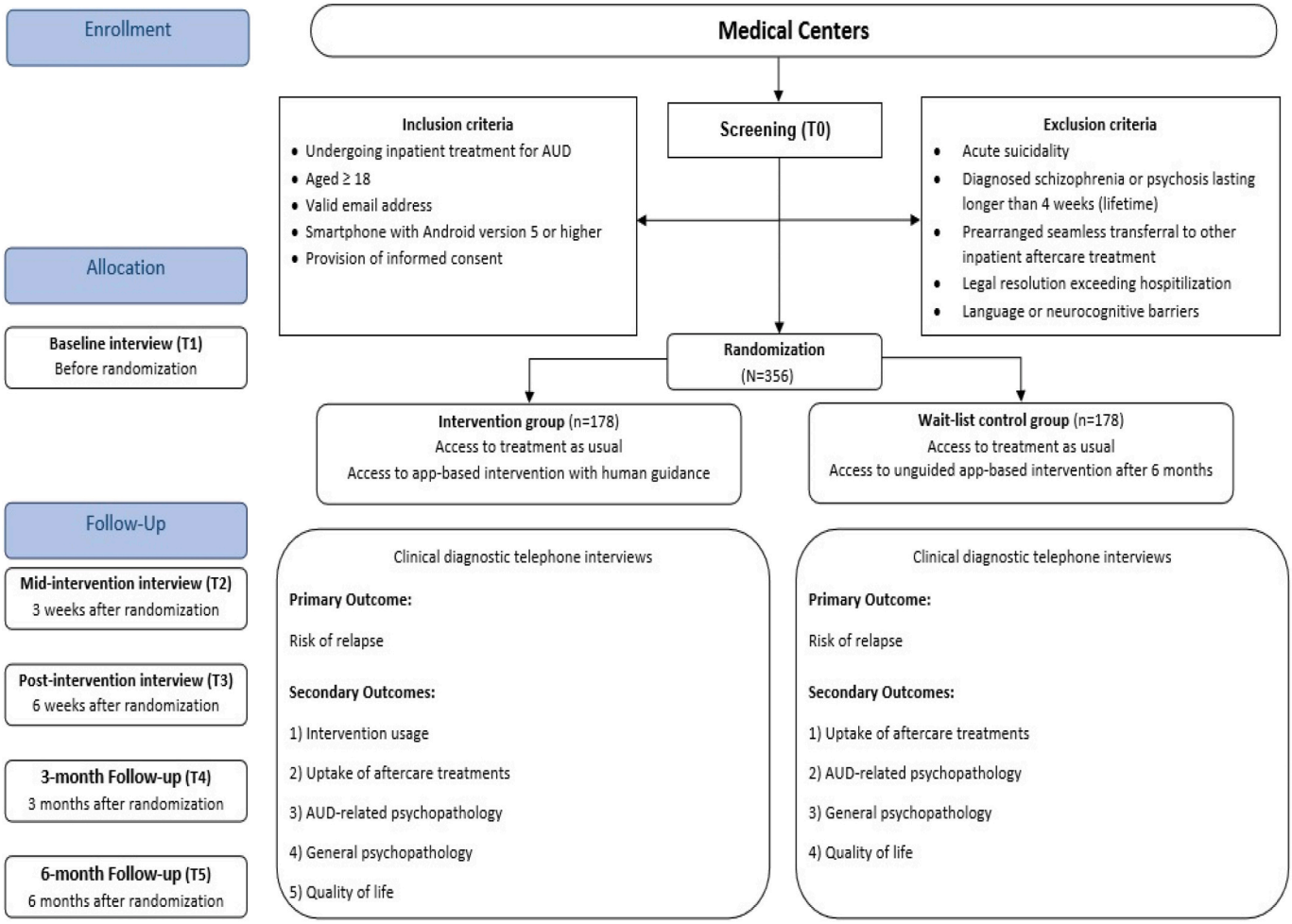


**Fig. 1.** Study flow.

the unguided app intervention until the active study phase ends (six months after randomization).

The app-based intervention was developed in an iterative and expert driven manner by clinicians, app developers, usability experts, and designers. It consists of 1) the app, 2) a protocol how the app is presented to patients during the acute inpatient treatment (*onboarding*), and 3) a protocol for the coaches supporting participants (*guidance*). All components are based on evidence-based treatments and include techniques from cognitive behavioural therapy (CBT), motivational interviewing and cognitive bias modification (Wiers et al., 2011). After presentation of the intervention in the participating medical centres, feedback from clinicians and practitioners was incorporated. In addition, recruiting psychologists and coaches were interviewed in qualitative interviews with the aim to improve content and usability of the app intervention during study recruitment. As of January 2021, results from the qualitative interviews were incorporated and an updated app intervention is provided to new study participants.

*2.5.1.1. App content.* The content of the app includes six components: *skill component*, *aftercare component*, *emergency area component*, *motivation component*, *abstinence counter component*, and *chat component*. Each component includes text, videos, images and audios as well as tasks that encourage participants' input like entering text or uploading voice messages. The *skill component* allows users to acquire and practice skills. For an overview of the skills and their respective content see Table 1. Some tasks comprise an Approach-Avoidance Bias Modification paradigm (Wiers et al., 2011) in which attitudes associated with alcohol intake are to be pushed away and attitudes associated with abstinence are to be pulled towards the users via screen swiping. The *aftercare component* provides users with extensive information about aftercare treatments. After identification of an adequate aftercare treatment during guidance, the coach can provide information (e.g., phone number, address, directions) in the *aftercare component* and users can complete a checklist that includes low-threshold steps for utilizing aftercare treatments. The coach can observe checklist entries and thus monitor and accompany the progress of uptake. In case of high craving, relapse risk, or relapse, users are recommended to use the *emergency area component* and follow prespecified steps on how to cope with these situations. Users are provided with nationwide emergency numbers, can add individual entries of support numbers, and are able to call these directly. The *motivation component* allows users to enter their personal reason for abstaining from alcohol. Users can choose to upload photos, enter text or record an audio and may change the components' content at any time.

Each day when first entering the app, users are asked about the intensity of craving they felt and whether they were abstinent during the past 24 h. The sum of all abstinent as well as non-abstinent days and the current streak of abstinent days are shown in the *abstinence counter component*. Users can use the *chat component* to contact their coach regarding organizational and content-related topics. Although chat messages are displayed immediately, the chat is designed as an asynchronous communication tool and thus does not serve as an acute support system.

Daily usage is recommended to complete the abstinence and craving query. In addition, the training of skills via the *skill component* is recommended three times a week with a duration of approximately 15 min. To enhance adherence, users can specify their preferred training times and receive a push notification as a reminder. The guidance complementing the app is delivered by telephone (as internet telephony is still less reliable than traditional phone networks).

*2.5.1.2. Onboarding.* Onboarding and introduction to the app took place in the medical centre by recruiting psychologists. Upon entering the app, users rate their agreement to different statements (e.g., "Each time I am stressed, I drink alcohol"), each of which represent one skill of the *skill component* and build the basis of the sequence in which the skills are to be completed. After rating each assertion, the sequence of the skills is compiled in a deficit-detecting manner. The duration of onboarding and introduction is about 30 min. With ongoing app usage, an algorithm is used for adapting the sequence of skills based on individual needs, usage pattern, motivation, deficits, and current relapse occurrences. Therefore, the original sequence of skills to train may change during use of the app via user input and queries.

*2.5.1.3. Guidance.* Guidance is provided by coaches who are licensed psychotherapists and takes place weekly during the first six weeks after discharge from the hospital for about 30 min via telephone (i.e., six appointments with a maximum of 3 h of guidance offered). The main aims of the human guidance are to 1) foster and strengthen motivation of the participants, 2) help identification and uptake of an aftercare treatment in accordance with patient needs, and 3) guide app usage and enhance intervention adherence. Therefore, coaches are provided with workshops and manuals on human guidance functionality, app content, and detailed information about the German healthcare system, including a comprehensive list of publicly accessible information about aftercare treatments (e.g., address, phone number, postal code) that allows direct recommendation of accessible aftercare treatments. To monitor adherence to the manuals and ensure quality, there are regular peer-exchange meetings and telephone guidance is recorded and monitored at random.

### 2.5.2. Control condition

Participants in the control condition have access to treatment as usual. After the 6-month follow-up assessment is completed, they receive access to an unguided version of the app.

**Table 1**
Lessons, skills and content of the skill component.

| Lessons | Skill and content |
|---|---|
| Boosting motivation | Boosting abstinence motivation, becoming aware of one's main reason for abstinence, weighing up the pros and cons of drinking alcohol |
| Emergency area | Emergency plan, common emergency numbers, personal telephone numbers for social support |
| Support during home transition | Transferring new skills into daily routine, throwing away alcohol supplies, making oneself feel comfortable at home |
| Relapse prevention | Understanding different stages of relapse, avoiding risk situations, turning relapse into abstinence |
| Coping with relapse | Stopping relapse, learning from relapse, decatastrophizing relapse |
| Management of risky situations | Understanding different stages of relapse, avoiding risk situations, turning relapse into abstinence |
| Coping with stress | Learning about the relationship between stress and relapse, taking time for recreation, reducing stresses and strains |
| Improving social skills | Maintaining social contacts, dealing with social conflicts, getting in touch with new people |
| Emotion regulation | Becoming aware of one's emotions, understanding emotions, regulating emotions |
| Self-support | Sympathizing with oneself, practicing self-praise, reassuring oneself |
| Boosting self-esteem | Becoming aware of one's positive traits, reducing self-criticism, focussing on achievements and positive experiences |
| Relaxation | Practicing progressive muscle relaxation, breathing mindfully, identifying stressful situations |
| Resource strengthening | Identifying achievements, becoming aware of one's strengths and skills, taking advantage of them regarding abstinence |
| Practicing enjoyment | Practicing mindfulness in everyday life, experiencing enjoyment in everyday activities |
| Future planning | Becoming aware of one's desires, translating desires into goals, defining short-term objectives |

### 2.6. Outcomes and assessments

Assessments are conducted via telephone by diagnostic interviewers who are trained on how to conduct the interviews, adhere to the guidelines, and deal with potential intoxication and suicidality during the interview (Table 2). Interviews are recorded to assess adherence to the guidelines and to allow subsequent ratings to calculate interrater-reliability. Therefore, intra-class correlation coefficients are calculated (two-way, absolute agreement, single rater) for 30 interviews, i.e. 5 per measurement point, which will be randomly selected and re-rated by two independent raters. To preserve blinding, participants are asked not to give any information about their allocation and reminded of this instruction verbally before each assessment. If unblinding happens, diagnostic interviewers are switched.

#### 2.6.1. Primary outcome

The risk of relapse (events and days until first relapse) is assessed by the Timeline Follow-Back Alcohol (TLFB, Sobell and Sobell, 1992) interview. The TLFB is a retrospective estimate of drinking events. Respondents are asked to identify common patterns of use (e.g., two beers per day) and to describe how it varies on a daily basis, allowing a quantity-frequency estimate of alcohol use. Participants are provided with a calendar of the past 12 months to enhance recall.

#### 2.6.2. Secondary outcomes

##### 2.6.2.1. Intervention usage

*2.6.2.1.1. Therapeutic alliance.* The German revised short form of the Working Alliance Inventory adapted for the use with internet-based interventions (WAI-SR; original: Horvath and Greenberg, 1989; short revised: Hatcher and Gillaspy, 2006; German: Wilmers et al., 2008; 12 items; item range: 1 [never] to 5 [always]; sum score range: 12 to 60; $\alpha = 0.90$ to 0.93) is utilized to assess therapeutic alliance. The measure includes the subscales agreement on the tasks of therapy (4 items, $\alpha = 0.85$ to 0.86), agreement on the goals of therapy (4 items, $\alpha = 0.81$ to 0.91), and development of an effective bond (4 items, $\alpha = 0.82$ to 0.83, Munder et al., 2010). Higher scores reflect better working alliance.

*2.6.2.1.2. Supportive accountability.* Supportive accountability is assessed using items based on the SA model of coaching (Mohr et al., 2011; 7 items; item range: 1 [strongly disagree] to 7 [strongly agree]; sum score range: 7 to 49). Higher sum scores indicate higher supportive accountability.

*2.6.2.1.3. Client satisfaction.* User satisfaction is assessed by the Client Satisfaction Questionnaire (CSQ-8, Larsen et al., 1979; 8 items; sum score range: 8 to 32; $\alpha = 0.93$, Attkisson and Zwick, 1982) adapted to assess user satisfaction in online interventions. Higher scores indicate higher satisfaction.

*2.6.2.1.4. System usability.* The System Usability Scale (SUS, Brooke, 1996; 10 items; item range: 1 [strongly disagree] to 5 [strongly

**Table 2**
Assessments and time points.

| Construct | Assessment | Time point | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | T0 | T1 | T2 | T3.1 | T3.2 | T4 | T5 |
| Socio-demographics | – | x | | | | | | |
| Intervention usage* | | | | | | | | |
| Amount of app use | – | | | | | | | |
| Therapeutic alliance | WAI | | | | | x | | |
| Reasons of dropout | Based on own development | | | | | x | | |
| Subjective training intensity | Based on own development | | | | | x | | |
| Supportive accountability | SA | | | x | | x | | |
| Client satisfaction | CSQ-8 | | | | | x | | |
| System usability | SUS | | | | | x | | |
| Treatment credibility and expectancy | CEQ | | x | | | x | | |
| Negative Effects | NEQ | | | | | x | | |
| Uptake of aftercare treatments | | | | | | | | |
| Uptake of aftercare treatments | Based on own development | | x | x | | x | x | x |
| Motivation for uptake of aftercare treatments | TEQ-9 | | | x | | x | | |
| AUD-related psychopathology | | | | | | | | |
| Relapse (yes/no), days of alcohol consumption | TLFB | | x | | x | | x | x |
| Diagnosis of AUD | SCID-5-CV | x | | | | | | x |
| Severity of AUD | SESA | | x | | | | | x |
| Severity of AUD | AUDIT | | x | | x | | x | x |
| Craving | OCDS-G | | x | x | x | | x | x |
| General psychopathology | | | | | | | | |
| Depressive symptoms | PHQ-9 | x | | x | x | | x | x |
| General anxiety disorder symptoms | GAD-7 | x | | x | x | | x | x |
| Social phobia | Mini-SPIN | x | | | | | | |
| Quality of sleep | PSQI | x | | x | x | | x | x |
| Quality of life | | | | | | | | |
| Well-being | WHO-5 | | x | | x | | | x |
| Quality of life | EQ-5D | | x | | x | | x | x |
| Other | | | | | | | | |
| Mindfulness | MAAS | | x | x | x | | x | |
| Emotional regulation skills | SEK-27 | | x | x | x | | x | |
| Locus of control | SOMS | x | | | | | | |
| Need for affect | NFA | x | | | | | | |
| Substance recovery | SURE | | x | | x | | | x |
| Impulsivity | BIS-15 | | x | x | x | | x | |
| Self-control | SCS-K-D | x | | | | | | |
| Self-efficacy | GSE | | x | x | | | x | |
| Abstinence self-efficacy | Based on own development | x | | | | | | |
| Health care service utility and productivity loss | TiC-P | | x | | | | x | x |
| Effects of COVID-19 pandemic | Based on own development | | x | x | | x | x | x |

* Intervention group only.

agree]; sum score range: 0 to 100; α = 0.91, Bangor et al., 2008) is used to measure usability of the intervention. A higher sum score indicates better evaluation of usability.

*2.6.2.1.5. Treatment credibility and client expectancy.* Treatment credibility and expectancy is assessed by the Credibility/Expectancy Questionnaire (CEQ, Borkovec and Nau, 1972; 6 items; α = 0.85, Devilly and Borkovec, 2000). Subscales are treatment credibility (3 items; item range: 1 [not at all logical/useful/confident] to 9 [very logical/useful/confident]; score range: 3 to 27; α = 0.86) and treatment expectancy (3 items; item range: 1/0% [not at all] to 9/100% [very much]; score range: 3 to 27; α = 0.90) with higher scores indicating higher credibility or expectancy.

*2.6.2.1.6. Negative effects.* Negative effects of the intervention are measured by the revised version of the Negative Effects Questionnaire (NEQ, Rozental et al., 2016; 20 items; α = 0.95). Frequencies of negative effects (item range: 0 [not experienced] to 1 [experienced]; sum score range: 0 to 20) and negative impact (item range: 0 [not at all] to 4 [extremely]; mean score range: 0 to 4) are assessed related to circumstances and treatment. Higher sum scores indicate more negative effects and higher mean scores indicate more negative impact.

*2.6.2.1.7. App use, dropout, subjective training intensity.* The amount of app use, reasons of dropout, and subjective training intensity are assessed via self-developed usage data and questions.

*2.6.2.2. Uptake of aftercare treatments*

*2.6.2.2.1. Uptake of aftercare treatments.* The uptake of an aftercare treatment (yes/no), time until uptake of an aftercare treatment, and termination of an aftercare treatment (yes/no) is assessed via self-developed questions.

*2.6.2.2.2. Motivation for the uptake of an aftercare treatment.* The motivation for uptake of an aftercare treatment is assessed by the Treatment Entry Questionnaire (TEQ-9, Urbanoski and Wild, 2012; 9 items; item range: 1 [strongly disagree] to 7 [strongly agree]; mean score range: 0 to 7) with the subscales internal motivation (α = 0.90), introjected motivation (α = 0.83) and external motivation (α = 0.87).

*2.6.2.3. AUD-related psychopathology*

*2.6.2.3.1. Symptom severity.* Severity of AUD is assessed with the Severity Scale of Alcohol Dependence (SESA, John et al., 2001; 33 items; mean score range: 0 to 100; α = 0.95). Subscales are narrowing of drinking repertoire (4 items; α = 0.86), somatic withdrawal symptoms (3 items; α = 0.86), alcohol consumption to avoid withdrawal symptoms (3 items; α = 0.92), psychological withdrawal symptoms (8 items; α = 0.95), increase of tolerance (4 items; α = 0.80), extreme increase of tolerance (2 items; α = 0.71) and decrease of tolerance (4 items; α = 0.79). A higher mean score based on weighted sum scores of subscales indicates a higher severity of AUD.

In addition, the Alcohol Use Disorder Identification Test (AUDIT, Babor and Grant, 1989; Saunders et al., 1993; 10 items; sum score range: 0 to 40; α = 0.94, Meneses-Gaya et al., 2010).

is used to screen participants regarding drinking frequency, typical quantity, and frequency of episodic heavy drinking within the past 12 months. A higher sum score implies a greater risk for alcohol dependence.

*2.6.2.3.2. Amount of alcohol consumption and drinking days.* The Alcohol Timeline Followback interview (TLFB, Sobell and Sobell, 1992) is used to assess consumption of alcohol, i.e. any relapse. Respondents are asked to identify common patterns of use (e.g., two beers per day) and to describe how this use varies day to day.

*2.6.2.3.3. Number of diagnosis criteria of AUD.* The German version of the structured clinical interview for DSM-5 Clinicians Version (SCID-5-CV; Beesdo-Baum et al., 2019; First et al., 2016) is used to diagnose AUD. 12 possible symptoms of AUD are explored to decide about severity: mild (2 to 3 symptoms), moderate (4 to 5 symptoms) or severe (more than 6 symptoms) AUD.

*2.6.2.3.4. Craving.* The 5-item version of the Obsessive Compulsive Drinking Scale (OCDS-G, Mann and Ackermann, 2000; 5 items; item range: 0 to 4; α = 0.81, de Wildt et al., 2005) is used for measuring craving symptoms. Higher scores indicate a higher level of craving.

*2.6.2.4. General psychopathology*

*2.6.2.4.1. Depressive symptoms.* Depressive symptom severity is measured by the Patient Health Questionnaire (PHQ-9, original: Spitzer et al., 1999, German: Gräfe et al., 2004; 9 items; item range: 0 [not at all] to 3 [almost every day]; sum score range: 0 to 27; α = 0.89, Kroenke et al., 2001) referring to the previous 2 weeks. Higher scores indicate a higher level of depressive symptoms (0 to 4: minimal, 5 to 9: mild, 10 to 14: moderate, 15 to 19: moderately severe, 20 to 27: severe).

*2.6.2.4.2. General Anxiety Disorder symptoms.* Generalized Anxiety Disorder symptom severity is measured by the Generalized Anxiety Disorder Assessment (GAD-7, Spitzer et al., 2006; 7 items; item range: 0 [not at all] to 3 [nearly every day], sum score range: 0 to 21; α = 0.89, Löwe et al., 2008). Higher scores indicate higher symptomatology (5 to 9: mild, 10 to 14: moderate, ≥15 severe).

*2.6.2.4.3. Social phobia.* To screen for social anxiety disorder, the German version of the Mini-Social Phobia Inventory (Mini-SPIN; original: Connor et al., 2001, German: Wiltink et al., 2017; 3 items; item range: 0 [not at all] to 4 [extremely]; sum score range: 0 to 12; α = 0.80 to 0.83) is used. Higher sum scores indicate greater manifestation of Social Anxiety Disorder.

*2.6.2.4.4. Quality of sleep.* Sleep Quality over the past 4 weeks is assessed by the 1-item subscale of the Pittsburgh Sleep Quality Index (PSQI, Buysse et al., 1989); item range: 1 [very good] to 4 [very bad]; score range: 0 to 3; α = 0.76). A higher score indicates less sleep quality.

*2.6.2.5. Quality of life*

*2.6.2.5.1. Well-being.* Well-being is assessed by the Well-Being Index (WHO-5, Staehr-Johansen, 1998; 5 items; item range: 0 [at no time] to 5 [all the time]; standardized score range: 0 to 100; α = 0.92, Brähler et al., 2007). A standardized score < 13 indicates poor well-being.

*2.6.2.5.2. Quality of life.* General health and life quality is assessed by the EuroQoL 5-dimension 5-level measure (EQ-5D-5L, Herdman et al., 2011; 6 items; item range: 1 [no problems] to 5 [unable/extreme], 0 [worst health] to 100 [best health]; α = 0.83, Marti et al., 2016). Health state is described as a five-digit index, where higher digits indicate more problems. The sixth item represents self-rated health in percent.

*2.6.2.6. Cost-effectiveness*

*2.6.2.6.1. Cost-effectiveness.* Cost-effectiveness is assessed via 1) healthcare consumption and productivity loss (Trimbos/iMTA questionnaire for Costs associated with Psychiatric Illness, TiC-P, Hakkaart-Van Roijen et al., 2002) and 2) statutory health insurance routine data.

*2.6.2.7. Others*

*2.6.2.7.1. Mindfulness.* The German version of the Mindful Attention and Awareness Scale (MAAS, Brown and Ryan, 2003; Michalak et al., 2008; 15 items; item range: 1 [almost always] to 6 [almost never], mean score range: 1 to 6; α = 0.83) is used to assess mindfulness. A higher mean score indicates higher mindfulness.

*2.6.2.7.2. Emotional regulation skills.* Emotion-specific coping strategies when dealing with general distress is assessed by the Assessment of Emotion Regulation Skills (SEK-27, Berking and Znoj, 2008; 27 items; item range: 0 [not at all] to 4 [almost always/always]; sum score range: 0 to 108; $\alpha_{\text{prolonged state}} = 0.90$). Subscales are: awareness (3 items; α = 0.81), regulation (3 items; α = 0.76), understanding (3 items; α = 0.73), resilience (3 items; α = 0.79), acceptance (3 items; α = 0.68), clarity (3 items; α = 0.79), body awareness (3 items; α = 0.75), readiness to confront (3 items; α = 0.77) and self-support (3 items; α = 0.72). Higher

sum scores indicate better emotional regulation.

*Locus of control.* The 5-item version of the Sense of Mastery Scale (SOMS, Pearlin and Schooler, 1978; 5 items; item range: 1 [strongly disagree] to 4 [strongly agree]; sum score range: 5 to 20; α = 0.77, Togari and Yonekura, 2015) is used to measure individuals' perceived life control and mastery. After reverse coding, higher sum scores indicate greater levels of mastery.

*2.6.2.7.3. Need for affect.* Four items of the Need for Affect Questionnaire (NFA, Maio and Esses, 2001; German: Appel, 2008; 4 items; item range: −3 [strongly disagree] to 3 [strongly agree]) is used to assess the motivation to approach or avoid emotion-inducing situations.

*2.6.2.7.4. Substance recovery.* Substance Use Recovery Evaluator (SURE, Neale et al., 2016; 21 items; item range: 1 to 3; sum score range: 21 to 63; α = 0.92) is used to assess substance recovery. Subscales are substance use (6 items; α = 0.83), self-care (5 items; α = 0.82), relationships (4 items; α = 0.74), material resources (3 items; α = 0.68) and outlook on life (3 items; α = 0.87). Higher sum scores indicate better substance recovery.

*2.6.2.7.5. Impulsivity.* Impulsivity is measured using the German version of the Barratt Impulsiveness Scale (BIS-15; original: Spinella, 2007, German: Meule et al., 2011; 15 items; item range: 1 [rarely/never]–4 [almost always/always]; sum score range: 15 to 60, α = 0.81). The measure includes the subscales non-planning (5 items, α = 0.82), motor (5 items, α = 0.72) and attentional impulsivity (5 items, α = 0.68). Higher scores indicate greater impulsivity.

*2.6.2.7.6. Self-control.* Self-control is measured using the German short version of the Self-Control Scale (SCS-K-D; original: Tangney et al., 2004, German: Bertrams and Dickhäuser, 2009; 13 items; item range: 1 [not at all] to 5 [very much]; mean score range: 1 to 5; α = 0.79–0.80). A higher mean score indicates better level of self-control.

*2.6.2.7.7. Self-efficacy.* Perceived self-efficacy is assessed using the revised German General Self-Efficacy Scale (GSE; Schwarzer and Jerusalem, 1995; 10 items; item range: 1 [not at all true] to 4 [exactly true]; sum score range: 10 to 40; α = 0.86 to 0.94, Luszczynska et al., 2005). A higher sum score indicates higher perceived self-efficacy.

*2.6.2.7.8. Abstinence self-efficacy.* Abstinence self-efficacy is assessed via self-developed questions.

*2.6.2.7.9. Effects of the COVID-19 pandemic.* In addition, the effects of the COVID-19 pandemic on drinking behavior and the use of aftercare treatments is assessed via self-developed questions.

### 2.7. Statistical analyses

For all statistical procedures, it will be tested whether preconditions are met. If necessary, they will be replaced with appropriate alternatives. All tests will be conducted at a significance level of 5%. Alpha-error accumulation will be corrected in cases of multiple testing. For all comparisons we will report *p*-values as well as effect sizes with corresponding 95% confidence intervals.

#### 2.7.1. Analysis of the primary outcome

For the analysis of differences in the risk of relapse between the intervention and control group at the 6-month follow-up, Kaplan-Meier curves, proportional log-rank survival analysis and Cox proportional hazard regressions analysis allowing for consideration of covariates will be used. To account for dropout, we will use available measurements and right censor data at the time of dropout. In addition, ITT-based (i.e., multiple imputation methods and conservative coding of participants who are dropped-out as relapsed) and per-protocol analyses will be performed.

#### 2.7.2. Analysis of the secondary outcomes

In order to analyse differences between intervention and control group in time to onset and probability of the utilization of aftercare at the 6-month follow-up, we will calculate proportional log-rank survival analysis and cox regression. With regard to the analysis of probabilities (termination of aftercare (all measurement points) and fulfilling the diagnosis of AUD (6-month follow-up), we will perform logistic regressions. Group differences in continuous measures (outcomes related to AUD, psychopathology, and quality of life) will be analysed using multilevel modeling for all available measurement points.

#### 2.7.3. Health economic analysis

The economic evaluation will be performed alongside the RCT. An incremental cost-effectiveness analysis and a cost-utility analysis will be conducted. For that purpose, the incremental cost-effectiveness analysis will examine costs per reduced relapse, and the cost-utility analysis will express costs per quality-adjusted life years (QALYs), using the EQ-5D-5L questionnaire. The economic evaluation will take the perspective of the German statutory health insurance (SHI) and the societal perspective on costs. For estimation of total costs from a SHI perspective, costs for outpatient and inpatient treatment, medication, remedies, aids, and disability will be determined by using routine data of three SHIs. Adopting the societal perspective, the questionnaire Treatment Inventory of Costs in Patients with psychiatric disorders (TiC-P) will be used to determine relevant resource use in mental health disorders and to record quantities of health-related resource use. These total costs will include direct healthcare and non-healthcare costs, as well as indirect healthcare costs due to loss of productivity. Unit costs will be calculated according to propositions for the German healthcare context (Bock et al., 2015; Krauth et al., 2005). We will conduct a multi-way sensitivity analysis to test the robustness of the best-case findings.

The robustness of the incremental cost-effectiveness ratio (ICER) will be checked by non-parametric bootstrapping (5.000 times). Bootstrap simulations will also be conducted to quantify the uncertainty around the ICER. The bootstrapped cost-effectiveness ratios will subsequently be plotted on a cost-effectiveness plane. The cost-effectiveness acceptability curve (CEAC) will estimate the probability that the intervention is cost-effective compared to treatment as usual, given observed data and the range of monetary values that a decision-maker might be willing to pay for a unit increase in health outcome measure.

## 3. Discussion

We developed an app-based intervention with human guidance that shall assist patients with AUD to master the challenge of maintaining the abstinence initiated during acute treatment and will evaluate the usability, efficacy, and cost-effectiveness of an app-based intervention with human guidance that shall assist patients with AUD to master the challenge of maintaining the abstinence initiated during acute inpatient treatment. To date, there is limited data on the efficacy and cost-effectiveness of app-based maintenance interventions applied after acute inpatient treatment (primarily focusing on detoxification) for individuals suffering from AUD. The few available studies indicate that there is still room for improvement with regard to the efficacy of these interventions (Colbert et al., 2020). It can be hypothesized that increasing the human guidance provided in app-based approaches and focusing on engaging patients into f2f aftercare treatments might help to fully exploit the potential that can, arguably, be ascribed to such interventions. The intended study will provide the data necessary to test this hypothesis.

There are several strengths to the study. First, the app is developed in an agile, data-driven fashion and represents the cutting edge of current app technology (with regard to usability, reliability and data security). Second, the intervention will be evaluated in a multicentre RCT with a large sample size conducted in both university and routine care clinics. Thus, the study controls for various threats for the internal validity, is powered sufficiently and allows conclusions with regard to both efficacy and effectiveness. Finally, the evaluation will be conducted by an independent institution not otherwise involved in the study.

There are also some limitations of the current study. First, we will ensure the highest quality standard when assessing relapse through the

patients self-reports in interviews. Nevertheless, this approach will be associated with threats for assessment validity inherent in self-report-based measures (Williams and Nowatzki, 2005). In the ideal study we thus would complement self-reports on alcohol use with additional sources of validation (e.g., collateral informants (Whitford et al., 2009)). In spite of the obvious advantages of additional indicators of relapse, we decided not to include these as their use would be associated with a participant burden likely to cause many participants from dropping out of the study. Second, as a significant part of participants will be treated in routine-care centres it can be assumed that the intended standardization of the intervention might be lower than it had been if all participants were treated in a highly controlled research environment. However, including a comparatively large number of participants from both university and routine-care centres will allow us to control for this factor (while maximizing the external validity). Third, we will compare the intervention with a waitlist control/TAU condition that will have access to treatment as usual only. This design has sometimes been criticized for overestimating the effects of the active condition (Cunningham et al., 2013). While it can be agreed upon this critique if the goal of the respective study is to identify mechanisms of change, from the perspective of health care system improvement the arguably most important questions refer to whether the new treatment is superior to routine care (with regard to efficacy and cost-effectiveness). This question is adequately addressed through the intended comparison with a waitlist control/TAU condition. Fourth, also with regard to the design, it can be argued that we should include active control conditions that would help us to systematically vary the degree of guidance and the focus on engaging participants in f2f-maintenance interventions. Similarly, it can be argued that we should compare the new intervention with the current gold-standard f2f maintenance. While we agree that such control conditions would be desirable, we decided not to include them in the present study as this would require an unrealistically large sample size. Instead, we will seek to provide an effect size for the comparison with the waitlist control/TAU condition that can be used to compare the efficacy of the intervention with the efficacy of other (gold standard) interventions that have also been compared with a waitlist control/TAU condition. If these effects will turn out to bear clinical significance, future studies should work to identify mechanisms of change and clarify the effectiveness in comparison with gold standard f2f-maintenance conditions. Finally, it is of note that (following an agile app-developing approach) we will utilize user feedback from the first part of the study to further improve the app for the second part of the study. Thus, we will need to investigate whether these two versions of the app differ with regard to their efficacy.

## 4. Conclusions

In sum, the study will extend earlier research on app-based interventions in individuals with AUD with regard to how such interventions can be used to support individuals having completed acute inpatient treatment for AUD. If shown to be efficacious, the intervention is aimed to be integrated in routine care in the German healthcare system. Due to the widespread use of and access to smartphones, its potential impact is not only limited to Germany, but could serve as a blueprint for routine AUD maintenance treatment in other countries with similar health care systems.

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## Declaration of competing interest

Professor Matthias Berking is stakeholder of the mentalis GmbH, which aims to implement scientific findings related to digital health interventions into routine care and developed the current study's app intervention. The other authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## References

Appel, M., 2008. Some like it hot: results of the german language version of an instrument aimed at the assessment of the need for affect/need for emotion. Diagnostica 54, 2–15.
Attkisson, C.C., Zwick, R., 1982. The client satisfaction questionnaire. Psychometric properties and correlations with service utilization and psychotherapy outcome. Eval. Program Plann. 5, 233–237.
Babor, T.F., Grant, M., 1989. From clinical research to secondary prevention: international collaboration in the development of the alcohol disorders identification test (AUDIT). Alcohol Health & Research World.
Bangor, A., Kortum, P.T., Miller, J.T., 2008. An empirical evaluation of the system usability scale. Int. J. Hum. Comput. Interact. 24, 574–594.
Barbosa, C., Bray, J.W., Dowd, W.N., Barnosky, A., Wittenberg, E., 2021. SF-6D utility scores for alcohol use disorder status and alcohol consumption risk levels in the US population. Addiction 116 (5), 1034–1042.
Beesdo-Baum, K., Zaudig, M., Wittchen, H.U., 2019. Strukturiertes Klinisches Interview für DSM-5®-Störungen – Klinische Version. Hogrefe, Göttingen.
Berking, M., Znoj, H., 2008. Entwicklung und validierung eines fragebogens zur standardisierten Selbsteinschätzung emotionaler kompetenzen (SEK-27). Z. Psychiatr. Psychol. Psychother. 56, 141–153.
Bertrams, A., Dickhäuser, O., 2009. Messung dispositioneller selbstkontroll-Kapazität. Diagnostica 55, 2–10.
Bock, J.O., Brettschneider, C., Seidl, H., Bowles, D., Holle, R., Greiner, W., Konig, H.H., 2015. Calculation of standardised unit costs from a societal perspective for health economic evaluation. Gesundheitswesen 77, 53–61.
Borkovec, T.D., Nau, S.D., 1972. Credibility of analogue therapy rationales. J. Behav. Ther. Exp. Psychiatry 3, 257–260.
Boss, L., Lehr, D., Schaub, M.P., Paz Castro, R., Riper, H., Berking, M., Ebert, D.D., 2018. Efficacy of a web-based intervention with and without guidance for employees with risky drinking: results of a three-arm randomized controlled trial. Addiction 113 (4), 635–646.
Brähler, E., Mühlan, H., Albani, C., Schmidt, S., 2007. Teststatistische Prüfung und normierung der deutschen versionen des EUROHIS-QOL Lebensqualität-index und des WHO-5 wohlbefindens-index. Diagnostica 53, 83–96.
Brooke, J., 1996. SUS: A "quick and dirty" usability scale. In: Jordan, P.W., Thomas, B., Weerdmeester, B.A., McClelland, A.L. (Eds.), Usability Evaluation in Industry. Taylor and Francis, London.
Brown, K.W., Ryan, R.M., 2003. The benefits of being present: mindfulness and its role in psychological well-being. J. Pers. Soc. Psychol. 84, 822–848.
Buchholz, A., Rosahl, A., Spies, M., Silkens, A., Scherbaum, N., Reimer, J., Hempleman, J., Röhrig, J., 2019. Vermittlung von patienten in eine postakutbehandlung nach dem stationären qualifizierten alkoholentzug. Suchttherapie 20, 212–219.
Buysse, D.J., Reynolds 3rd, C.F., Monk, T.H., Berman, S.R., Kupfer, D.J., 1989. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res 28, 193–213.
Castillo-Carniglia, A., Keyes, K.M., Hasin, D.S., Cerdá, M., 2019. Psychiatric comorbidities in alcohol use disorder. Lancet Psychiatry 6, 1068–1080.
Colbert, S., Thornton, L., Richmond, R., 2020. Smartphone apps for managing alcohol consumption: a literature review. Addict. Sci. Clin. Pract. 15, 17.
Connor, K.M., Kobak, K.A., Churchill, L.E., Katzelnick, D., Davidson, J.R., 2001. Mini-SPIN: a brief screening assessment for generalized social anxiety disorder. Depress Anxiety 14, 137–140.
Cunningham, J.A., Kypri, K., McCambridge, J., 2013. Exploratory randomized controlled trial evaluating the impact of a waiting list control design. BMC Med. Res. Methodol. 13, 150.
Czapla, M., Simon, J.J., Richter, B., Kluge, M., Friederich, H.C., Herpertz, S., Mann, K., Herpertz, S.C., Loeber, S., 2016. The impact of cognitive impairment and impulsivity on relapse of alcohol-dependent patients: implications for psychotherapeutic treatment. Addict. Biol. 21, 873–884.
de Wildt, W.A., Lehert, P., Schippers, G.M., Nakovics, H., Mann, K., van den Brink, W., 2005. Investigating the structure of craving using structural equation modeling in analysis of the obsessive-compulsive drinking scale: a multinational study. Alcohol. Clin. Exp. Res. 29, 509–516.
Devilly, G.J., Borkovec, T.D., 2000. Psychometric properties of the credibility/expectancy questionnaire. J. Behav. Ther. Exp. Psychiatry 31, 73–86.
First, M.B., Williams, J.B., Karg, R.S., Spitzer, R.L., 2016. Structured Clinical Interview for DSM-5, Clinician Version (SCID-5-CV). Arlington, VA, American Psychiatric Association.
Gabriels, C.M., Macharia, M., Weich, L., 2018. Psychiatric comorbidity and quality of life in South African alcohol use disorder patients. Qual. Life Res. 27, 2975–2981.
Gräfe, K., Zipfel, S., Herzog, W., Löwe, B., 2004. Screening psychischer Störungen mit dem "Gesundheitsfragebogen für patienten (PHQ-D)". Diagnostica 50, 171–181.

Gustafson, D.H., McTavish, F.M., Chih, M.Y., Atwood, A.K., Johnson, R.A., Boyle, M.G., Levy, M.S., Driscoll, H., Chisholm, S.M., Dillenburg, L., Isham, A., Shah, D., 2014. A smartphone application to support recovery from alcoholism: a randomized clinical trial. JAMA Psychiatry 71, 566–572.
Hakkaart-Van Roijen, L., Van Straten, A., Donker, M., Tiemens, B., 2002. Manual Trimbos/iMTA Questionnaire for Costs Associated With Psychiatric Illness (TiC-P). Erasmus University, Rotterdam.
Hatcher, R.L., Gillaspy, J.A., 2006. Development and validation of a revised short version of the working alliance inventory. Psychother. Res. 16, 12–25.
Herdman, M., Gudex, C., Lloyd, A., Janssen, M., Kind, P., Parkin, D., Bonsel, G., Badia, X., 2011. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). Qual. Life Res. 20, 1727–1736.
Horvath, A.O., Greenberg, L.S., 1989. Development and validation of the working Alliance inventory. J. Couns. Psychol. 36, 223–233.
Johansson, M., Sinadinovic, K., Gajecki, M., Lindner, P., Berman, A.H., Hermansson, U., Andreasson, S., 2021. Internet-based therapy versus face-to-face therapy for alcohol use disorder, a randomized controlled non-inferiority trial. Addiction 116, 1088–1100.
John, U., Hapke, U., Rumpf, H.-J., Schumann, A., 2001. Entwicklung und Testgüte der skala zur erfassung der schwere der Alkoholabhängigkeit (SESA). Sucht 47, 414–420.
Krauth, C., Hessel, F., Hansmeier, T., Wasem, J., Seitz, R., Schweikert, B., 2005. Empirical standard costs for health economic evaluation in Germany – a proposal by the working group methods in health economic evaluation. Gesundheitswesen 67, 736–746.
Kroenke, K., Spitzer, R.L., Williams, J.B., 2001. The PHQ-9: validity of a brief depression severity measure. J. Gen. Intern. Med. 16, 606–613.
Larsen, D.L., Attkisson, C.C., Hargreaves, W.A., Nguyen, T.D., 1979. Assessment of client/patient satisfaction: development of a general scale. Eval. Program Plann. 2, 197–207.
Linardon, J., Cuijpers, P., Carlbring, P., Messer, M., Fuller-Tyszkiewicz, M., 2019. The efficacy of app-supported smartphone interventions for mental health problems: a meta-analysis of randomized controlled trials. World Psychiatry 18, 325–336.
Loeber, S., Croissant, B., Heinz, A., Mann, K., Flor, H., 2006. Cue exposure in the treatment of alcohol dependence: effects on drinking outcome, craving and self-efficacy. Br. J. Clin. Psychol. 45, 515–529.
Löwe, B., Decker, O., Müller, S., Brähler, E., Schellberg, D., Herzog, W., Herzberg, P.Y., 2008. Validation and standardization of the generalized anxiety disorder screener (GAD-7) in the general population. Med. Care 46, 266–274.
Luszczynska, A., Scholz, U., Schwarzer, R., 2005. The general self-efficacy scale: multicultural validation studies. J. Psychol. 139, 439–457.
Maio, G.R., Esses, V.M., 2001. The need for affect: individual differences in the motivation to approach or avoid emotions. J. Pers. 69, 583–615.
Mann, K., Ackermann, K., 2000. Die OCDS-G: psychometrische kennwerte der deutschen version der obsessive compulsive drinking scale. Sucht 46, 90–100.
Mann, K., Batra, A., Fauth-Buhler, M., Hoch, E., The Guideline, G., 2017. German guidelines on screening, diagnosis and treatment of alcohol use disorders. Eur. Addict Res. 23, 45–60.
Marti, C., Hensler, S., Herren, D.B., Niedermann, K., Marks, M., 2016. Measurement properties of the EuroQoL EQ-5D-5L to assess quality of life in patients undergoing carpal tunnel release. J. Hand Surg. Eur. 41, 957–962.
McKay, J.R., Hiller-Sturmhofel, S., 2011. Treating alcoholism as a chronic disease: approaches to long-term continuing care. Alcohol Res Health 33, 356–370.
Mellentin, A.I., Nielsen, B., Nielsen, A.S., Yu, F., Mejldal, A., Nielsen, D.G., Stenager, E., 2019. A Mobile phone app featuring Cue exposure therapy as aftercare for alcohol use disorders: an investigator-blinded randomized controlled trial. JMIR Mhealth Uhealth 7, e13793.
Meneses-Gaya, C., Zuardi, A.W., Loureiro, S.R., Hallak, J.E., Trzesniak, C., De Azevedo Marques, J.M., Machado-De-Sousa, J.P., Chagas, M.H., Souza, R.M., Crippa, J.A., 2010. Is the full version of the AUDIT really necessary? Study of the validity and internal construct of its abbreviated versions. Alcohol Clin. Exp Res 34, 1417–1424.
Meule, A., Vögele, C., Kübler, A., 2011. Psychometrische evaluation der deutschen barratt impulsiveness scale – kurzversion (BIS-15). Diagnostica 57, 126–133.
Michalak, J., Heidenreich, T., Ströhle, G., Nachtigall, C., 2008. Die deutsche version der mindful attention and awareness scale (MAAS): psychometrische befunde zu einem achtsamkeitsfragebogen. [German version of the mindful attention an awareness scale (MAAS)—Psychometric features of a mindfulness questionnaire.]. Z. Klin. Psychol. Psychother. 37, 200–208.
Milne-Ives, M., Lam, C., de Cock, C., van Velthoven, M.H., Meinert, E., 2020. Mobile apps for health behavior change in physical activity, diet, drug and alcohol use, and mental health: systematic review. JMIR Mhealth Uhealth 8, e17046.
Mohapatra, S., Patra, J., Popova, S., Duhig, A., Rehm, J., 2010. Social cost of heavy drinking and alcohol dependence in high-income countries. Int. J. Public Health 55, 149–157.
Mohr, D.C., Cuijpers, P., Lehman, K., 2011. Supportive accountability: a model for providing human support to enhance adherence to eHealth interventions. J. Med. Internet Res. 13, e30.
Mojtabai, R., Olfson, M., Sampson, N.A., Jin, R., Druss, B., Wang, P.S., Wells, K.B., Pincus, H.A., Kessler, R.C., 2011. Barriers to mental health treatment: results from the National Comorbidity Survey Replication. Psychol. Med. 41, 1751–1761.
Munder, T., Wilmers, F., Leonhart, R., Linster, H.W., Barth, J., 2010. Working Alliance inventory-short revised (WAI-SR): psychometric properties in outpatients and inpatients. Clin. Psychol. Psychother. 17, 231–239.
Neale, J., Vitoratou, S., Finch, E., Lennon, P., Mitcheson, L., Panebianco, D., Rose, D., Strang, J., Wykes, T., Marsden, J., 2016. Development and validation of 'Sure': a patient reported outcome measure (Prom) for recovery from drug and alcohol dependence. Drug Alcohol Depend. 165, 159–167.
Pearlin, L.I., Schooler, C., 1978. The structure of coping. J. Health Soc. Behav. 19, 2–21.
Rehm, J., Shield, K.D., 2019. Global burden of alcohol use disorders and alcohol liver disease. Biomedicines 7.
Riper, H., Hoogendoorn, A., Cuijpers, P., Karyotaki, E., Boumparis, N., Mira, A., Andersson, G., Berman, A.H., Bertholet, N., Bischof, G., Blankers, M., Boon, B., Boss, L., Brendryen, H., Cunningham, J., Ebert, D., Hansen, A., Hester, R., Khadjesari, Z., Kramer, J., Murray, E., Postel, M., Schulz, D., Sinadinovic, K., Suffoletto, B., Sundstrom, C., de Vries, H., Wallace, P., Wiers, R.W., Smit, J.H., 2018. Effectiveness and treatment moderators of internet interventions for adult problem drinking: an individual patient data meta-analysis of 19 randomised controlled trials. PLoS Med. 15, e1002714.
Roerecke, M., Rehm, J., 2014. Cause-specific mortality risk in alcohol use disorder treatment patients: a systematic review and meta-analysis. Int. J. Epidemiol. 43, 906–919.
Rozental, A., Kottorp, A., Boettcher, J., Andersson, G., Carlbring, P., 2016. Negative effects of psychological treatments: an exploratory factor analysis of the negative effects questionnaire for monitoring and reporting adverse and unwanted events. PLoS One 11, e0157503.
Saunders, J.B., Aasland, O.G., Babor, T.F., de la Fuente, J.R., Grant, M., 1993. Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption–II. Addiction 88, 791–804.
Schoepf, D., Heun, R., 2015. Alcohol dependence and physical comorbidity: increased prevalence but reduced relevance of individual comorbidities for hospital-based mortality during a 12.5-year observation period in general hospital admissions in urban north-west England. Eur. Psychiatry 30, 459–468.
Schomerus, G., Lucht, M., Holzinger, A., Matschinger, H., Carta, M.G., Angermeyer, M.C., 2011. The stigma of alcohol dependence compared with other mental disorders: a review of population studies. Alcohol Alcohol. 46, 105–112.
Schwarzer, R., Jerusalem, M., 1995. Generalized self-efficacy scale. Measures in health psychology: a user's portfolio. In: Causal and Control beliefs. NFER-Nelson, Windsor, UK.
Sobell, L.C., Sobell, M.B., 1992. Timeline follow-back. In: Litten, R.Z., Allen, J.P. (Eds.), Measuring Alcohol Consumption. Humana Press, Totowa, NJ.
Spinella, M., 2007. Normative data and a short form of the Barratt Impulsiveness Scale. Int. J. Neurosci. 117, 359–368.
Spitzer, R.L., Kroenke, K., Williams, J.B., 1999. Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. Primary care evaluation of mental disorders. Patient Health Questionnaire. Jama 282, 1737–1744.
Spitzer, R.L., Kroenke, K., Williams, J.B., Lowe, B., 2006. A brief measure for assessing generalized anxiety disorder: the GAD-7. Arch. Intern. Med. 166, 1092–1097.
Staehr-Johansen, K., 1998. The use of well-being measures in primary health care – the Dep-Care project. In: Well-being Measures in Primary Health Care – The DepCare Project. World Health Organization, Geneva.
Tangney, J.P., Baumeister, R.F., Boone, A.L., 2004. High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. J. Pers. 72, 271–324.
Togari, T., Yonekura, Y., 2015. A japanese version of the Pearlin and Schooler's sense of mastery scale. Springerplus 4, 399.
Ugochukwu, C., Bagot, K.S., Delaloye, S., Pi, S., Vien, L., Garvey, T., Bolotaulo, N.I., Kumar, N., Ishak, W.W., 2013. The importance of quality of life in patients with alcohol abuse and dependence. Harv. Rev. Psychiatry 21, 1–17.
Urbanoski, K.A., Wild, T.C., 2012. Assessing self-determined motivation for addiction treatment: validity of the treatment entry questionnaire. J. Subst. Abus. Treat. 43, 70–79.
Weisel, K.K., Fuhrmann, L.M., Berking, M., Baumeister, H., Cuijpers, P., Ebert, D.D., 2019. Standalone smartphone apps for mental health-a systematic review and meta-analysis. NPJ Digit Med 2, 118.
Whitford, J.L., Widner, S.C., Mellick, D., Elkins, R.L., 2009. Self-report of drinking compared to objective markers of alcohol consumption. Am. J. Drug. Alcohol Abuse 35, 55–58.
Wiers, R.W., Eberl, C., Rinck, M., Becker, E.S., Lindenmeyer, J., 2011. Retraining automatic action tendencies changes alcoholic patients' approach bias for alcohol and improves treatment outcome. Psychol. Sci. 22, 490–497.
Williams, R.J., Nowatzki, N., 2005. Validity of adolescent self-report of substance use. Subst. Use Misuse 40, 299–311.
Wilmers, F., Munder, T., Leonhart, R., Herzog, T., Plassmann, R., Barth, J., Linster, H., 2008. Die deutschsprachige Version des Working Alliance Inventory - short revised (WAI-SR) - Ein schulenübergreifendes, ökonomisches und empirisch validiertes Instrument zur Erfassung der therapeutischen Allianz. Klin. Diagn. Eval. 1 (3), 343–358. Klinische DIagnostik & Evaluation, 1.
Wiltink, J., Kliem, S., Michal, M., Subic-Wrana, C., Reiner, I., Beutel, M.E., Brähler, E., Zwerenz, R., 2017. Mini - social phobia inventory (mini-SPIN): psychometric properties and population based norms of the German version. BMC Psychiatry 17, 377.
Witkiewitz, K., Litten, R.Z., Leggio, L., 2019. Advances in the science and treatment of alcohol use disorder. Sci. Adv 5, eaax4043.
World Health Organization, 2018. Global Status Report on Alcohol and Health 2018.