



## Features and functionality of the Iterapi platform for internet-based psychological treatment



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### ABSTRACT

The purpose of this article is to describe an internet-based platform for improving symptoms and quality of life for people with psychological and behavioural health problems such as depression, anxiety, phobia, psychological trauma, hearing loss and tinnitus. The online platform, called Iterapi, was developed at the Department of Behavioural Sciences and Learning at Linköping University, Sweden and has been running for nearly two decades and used in many randomized controlled trials and outpatient treatments.

The intention of this article is to share our experience with developing such a treatment solution and the process flow and elements of running internet-based psychological interventions. This will likely be of use to developers building similar services, therapists considering integrating such approaches in their practices and institutions, as well as researchers curious about the functions included on the platform and methodology used for running studies.

We describe the security aspects of the platform, central concepts underlying its development, how the platform can be used in a study or treatment and the main features and functions the platform offers. We comment on practical considerations regarding blending of methods within the platform, such as self-help treatments with asynchronous communication and real-time text chat and video conversations. We also point out the advantages of using Internet-assisted treatments, the challenges that we have faced and future planned upgrades.

Due to continuous development of the platform, its user-friendliness, accessibility across devices and numerous features, many research colleagues from Sweden as well as other countries such as Germany, United Kingdom, Romania and Israel have chosen to implement their own studies on the platform.

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### 1. Introduction

During the past few years the use of the Internet and modern information technology has transformed the provision of psychological services and the healthcare industry in general. Meta-analyses of information technology based approaches to delivering psychological assistance, for example internet-based cognitive-behavioural therapy (ICBT), have identified it as not significantly different than face-to-face treatment for a range of disorders (Andersson et al., 2014). For anxiety disorders specifically, a recent Cochrane Review identified therapist-supported ICBT as more effective in reducing anxiety symptoms than wait-list and not different than face-to-face treatment (Olthuis et al., 2016).

The main methodology in these studies is a guided self-help program administered through an online treatment platform, where participants can interact with therapists in a secure way and perform a number of activities as part of their treatment, such as reading specific treatment modules, answering self-report questionnaires on treatment progress, doing interactive homework, watching videos, listening to audio files, and more (Andersson, 2014).

Due in part to the beneficial outcomes of patients treated using ICBT, as well as cost-effectiveness (Hedman et al., 2014), ease of access (Muñoz, 2010; Griffiths and Christensen, 2007), improved screening and assessment (Houston et al., 2001), as well as reduced stigma due to online anonymity (Gega et al., 2004), there are now many solutions for delivering health services through the Internet via web platforms and mobile applications. Examples of these include: Deprexis ([www.deprexis.com](http://www.deprexis.com)), Minddistrict ([www.minddistrict.com](http://www.minddistrict.com)), SilverCloud ([www.silvercloudhealth.com](http://www.silvercloudhealth.com)), ICT4DEPRESSION ([www.ict4depression.eu](http://www.ict4depression.eu)), Online-Therapy.com ([www.online-therapy.com](http://www.online-therapy.com)), THIS WAY UP ([thiswayup.org.au](http://thiswayup.org.au)), Moodbuster ([moodbuster.eu](http://moodbuster.eu)), and MindSpot ([mindspot.org.au](http://mindspot.org.au)).

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The purpose of this study is to describe the Iterapi platform developed at Linköping University, its functionality, process flow, security aspects, challenges encountered and central concepts used during development, as well as key e-treatment features that have proven useful based on our 18 years experience. We expect that the detailed description of this platform, which is typically seen only by researchers using the platform and patients included in Iterapi-based treatments, will provide support to other institutions hoping to develop their own solution and help researchers understand the process-flow used in running an internet-based mental health treatment.

Studies show that programs delivered on the Iterapi platform reduce psychological problems for a range of disorders from both somatic problems such as hearing loss (Thorén et al., 2014) and tinnitus (Hesser et al., 2012) to more traditional psychological difficulties such as anxiety (Tulbure et al., 2015) and depression (Johansson et al., 2012).

In addition to the Department of Behavioural Sciences and Learning at Linköping University (Sweden) a number of other researchers and psychologists have used the platform for their own studies and provided essential input and feedback on the platform's features and development. These include collaborations with researchers at Stockholm University (Rozenal et al., 2015), Göteborg University (Malmberg et al., 2015), Umeå University (Månsson et al., 2015), Uppsala University, Karolinska Institute, University of Marburg – Germany (Jasper et al., 2014), University College London, Anglia Ruskin University – United Kingdom, The Hebrew University of Jerusalem – Israel, as well as West University in Timisoara – Romania (Tulbure et al., 2015).

Our statements about the usability of the platform and the usefulness of the individual features are based on answers to dedicated questionnaires addressed together with post-measurements to participants in the studies, questionnaires posed to therapists, as well as constant text and oral feedback we receive from therapists and patients alike.

## 2. Overview of the Iterapi platform

The Iterapi platform was developed primarily for the purposes of running research studies such as randomized-controlled trials for the treatment of psychological problems. Built incrementally over the course of 18 years, the system is designed primarily for security, efficiency of process flow for patients, therapists and administrators, customizability for ensuring a multiplicity of treatment modalities (text, voice, and video), user-friendly information management systems including integrated questionnaire data collection, graphical patient progress indicators, easy data exporting, as well as adaptability to diverse implementation environments (mixing mobile, desktop and operating system).

Each study or treatment that runs on the platform has its own website with its own data space, language and design. The studies also have their own URL addresses and there are a number of existing templates a study may choose from that are highly customizable, in terms of colours, logos and layout. There is a natural divide on the platform between a public area where information about the research project is presented to a general audience, such as information “About the study,” “Who can participate,” “Who are we,” “How to register,” etc. and a private area, where therapists and participants can login and work with the treatment.

Advertisement of the study is completed via sharing of the public page URL on different media outlets (social media, institutional information panels, newspapers, radio etc.) where participants can register their email address and fill in a screening questionnaire (if the study has one). Public pages may be rapidly deployed using existing templates or edited by both administrators and therapists (after logging into the platform) using a WYSIWYG (What You See Is What You Get) editor, similar to common desktop editors like Word.

The platform supports multiple languages, and the whole interface, including an internal messaging system (described below) and

automated page content, are currently available in English, Swedish, German, Romanian and Hebrew. The platform can quickly be translated into any other language using a simple Excel file exported from the platform. The treatment content may also be added in any language, and the platform has full support for right-to-left languages like Hebrew and Arabic. In Fig. 1 below we illustrate an example of a layout used by a study on the platform.

## 3. The start page

After logging into the platform from the publicly viewable web page, all users are directed to a simple and clean internal start page covering all entry points to other sections of the platform. This includes areas described in the next section such as treatment modules, homework, conversations with therapists, discussion forums, answers to questionnaires, etc.

The same start page is shown to therapists and editors, who generally want to know how the platform is displayed to their patients. Additionally, therapists and editors have access to an administrative section (described below) from where they can quickly access all areas needed for administrating, communicating, reviewing activities from their patients and exporting data.

The start page also includes a notification centre, where users are alerted to important actions they must respond to, for example a new message from their therapist, a new chat invitation or a new questionnaire to answer. Inspiration for the notification centre comes from current mobile devices technology enabling all requests requiring a response to be centralized in a single location.

An important feature of the platform is that the layout of pages is fully responsive, transparently adapting to screen size and ensuring a fully-functional and rich user experience regardless of whether the platform is accessed using a desktop computer, mobile phone (smartphone) or tablet. We illustrate this in Supplemental Fig. I and Supplemental Fig. II. On smaller screens, menu options normally displayed across the top of the screen are minimized and instead displayed vertically so that content is available without having to zoom or scroll horizontally.

## 4. Iterapi-based treatments

The treatment components of the Iterapi platform are designed to be flexible enough and allow sufficient customization to ensure effective therapies and research studies can be developed for a wide range of psychological health challenges. The treatment components of an Iterapi-based Internet intervention include a self-help directed treatment area (treatment module), information collection forms (worksheets), a communications system (audio/video/text conversations) and discussion forum system. A questionnaire module is also tightly integrated into the treatment components (discussed below).

### 4.1. Treatment modules

Treatment modules can be presented with a variety of formatted text and include embedded web pages, images and PDF files. Data collecting worksheets may be inserted, as well as video and audio files shared internally on the platform by the research team or linked externally. A user-friendly WYSIWYG editor allows formatting by either IT-developers or therapists. We present an example of the treatment module layout in Supplemental Fig. III and Supplemental Fig. IV. These screenshots are from a specific study, and other studies may use different layouts with the same functionality.

A treatment module is normally divided into chapters for easier reading and may be composed of single or multiple branches, e.g. one branch for delivering cognitive-behavioural treatment (CBT) and one branch for delivering acceptance and commitment therapy (ACT). Modules may be assigned to participants on a scheduled basis, such as weekly which is common (cf., Carlbring and Andersson, 2006).



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## What happens during the study?

There are two parts during the study. The first stage is a screening process, from which participants will be selected for the actual treatment. The second phase, is undergoing the intervention through access to the various modules of the treatment. This study has received ethical approval. The steps in each stage are described below:

### Screening process

1. You are able to register your interest in the study by clicking on the link on the 'who may join' tab. You will be asked to provide an e-mail address. Initially you will be placed on a waiting list.
2. At the launch of this project, we will send you an invitation, via e-mail to register and consent to participating. You will then be sent a link to a detailed questionnaire, related to your tinnitus and the effects your tinnitus may have on you. This questionnaire may take around 30 minutes to complete, as it is important to gain as much information about your tinnitus as possible. Be assured that all information will be kept confidential and anonymous.
3. After completing this questionnaire, you will receive a telephone call to discuss certain aspects of your tinnitus and to provide the opportunity for you to ask questions related to the study. If hearing on the telephone is problematic, an alternative form of communication will be used.



Fig. 1. Screenshot of a study website: Tackling Tinnitus, in English layout primarily designed by George Vlaescu and Eldre Beukes.

Having modules structured on different branches and the possibility of freely assigning any module to participants during treatment gives therapists an easy means of creating tailored interventions (cf., Carlbring et al., 2011).

#### 4.2. Worksheets

Worksheets are an important resource within the platform, and are mainly used for the registration of homework assignments, diaries, and quizzes. The form may be freely edited using HTML-code, which permits the inclusion of features such as text boxes, radio buttons, sliders and tables. In this section users can view all the worksheets assigned to them at a time and if they have been completed. Uploading files to the worksheets is possible for users who choose to write their answers on paper. Supplemental Figs. V and VI describe worksheet pages embedded within a treatment module.

#### 4.3. Conversations

Conversations provide a central functionality on the platform, taking the form of both real-time chat discussions using text, audio and recent video or a non-synchronous threaded messaging service for communication between a therapist and their patients.

##### 4.3.1. Messaging service

The messaging service is likely to be the first communication system used by participants and their therapists on the platform, to book an appointment or receive feedback on a treatment module. It uses a format

similar to other online services with simple threads that are easy to follow and reply to. A therapist may at any time initiate a conversation with any of their patients, whereas a patient may initiate a conversation only with his/her assigned therapist. An email notification (excluding the message itself) is sent to the receiver whenever a new message is added in a conversation, enabling the recipient to log into the platform and read its contents. There is also the ability to attach files to entries in a conversation. These files are automatically scanned on the server, to ensure their integrity (i.e. that they do not contain any viruses).

Participants may rate messages from their therapist anonymously, with a user-friendly scale measuring how helpful each message was to the participant. These ratings may later be analyzed by study supervisors and can even be related to weekly measurements collected for that participant to determine how participation status was affected by them.

A reviewer may also analyze and rate different characteristics of a therapist message, e.g. skills in delivering treatment and relationship quality with the client. These ratings are automatically linked by the platform to the weekly measurements for the participant and may prove useful when analyzing the efficacy of therapist conversations during treatment.

##### 4.3.2. Real-time text and audio-video conversations

A real-time chat feature was recently added, enabling live one-to-one conversations between therapists and their patients using text, video or audio. Evidence has suggested that therapeutic alliance and treatment effectiveness is not substantially different between face-to-face, video and audio treatment formats (Day and Schneider, 2002). A

randomized-controlled trial comparing CBT for mood and anxiety disorders delivered face-to-face and via videoconferencing found no significant difference between treatment formats after 12 sessions in terms of anxiety and depression outcomes and working alliance (Stubbings et al., 2013). A similar result was found in comparing telephone-administered CBT to face-to-face at post-treatment (but not follow-up), identifying the novel treatment as non-inferior in regards to depression outcomes and with better adherence (Mohr et al., 2012). Inclusion of the feature will allow the ability to provide blended treatment depending on the study and needs of the patient. Feedback from various categories of users with diverse computer and mobile habits (both patient and therapist) were sought during development in order to deliver a solution with a familiar looking interface, ensuring users can quickly start a chat, find chat logs and adjust settings during conversation. Effort was made to ensure complex operations that might be barriers to the initiation of a conversation were avoided.

One-to-one audio/video conversations between therapists and participants are included within the platform pages and work on all computers and most mobile devices. The primary advantage of this feature is that users only need one entry point for all tasks, eliminating the need for using a third-party program or application. Newly included communication features provided in web browsers via the WebRTC peer-to-peer component system (World Wide Web Consortium., 2016) allow all traffic during conversation sessions to be encrypted, without any use of plugins or third-party programs, and involve only the users' devices and platform servers. Technically, the audio and video traffic occurs directly between the users' devices, with the server being involved only in the initial phase to synchronize the clients. No additional constraints exist on server capacity for processing and bandwidth.

Full logs of text chat sessions are always saved, and may be reviewed at any time by either of the participants in the conversation. In a

movement towards a full-fledged health care solution, future implementations of this feature will enable the recording of whole audio/video sessions to be stored by the therapist when requested.

Real-time chat functions are initiated from the Conversations section of the platform under the "Chat tab." Patients are able to contact only their specified therapist whereas therapists may initiate contact with any of their clients. Chat sessions are always initiated with text and an "enable audio/video" icon will be made available. Webcam video is provided first to the local user who can ensure the image is correct before it is shared. This screen, like the rest of the platform, is mobile-friendly and responsive, adapting itself to the size of the device on which it is used. During a video conversation the text chat remains running (as shown in Fig. 2). On mobile devices the full-width of the recipient image is shown at the top of the screen, followed by the text chat. During conversations, options are given to enable/disable the local microphone, local image and remote speakers.

#### 4.4. Discussion forums

Discussion forums have been used in internet-based psychological treatments both as means of incorporating non-specific therapeutic factors similar to group therapy but within an online setting (Berger et al., 2009), as well as an alternative to wait-listed controls (Carlbring et al., 2011). Each defined group on the platform has an associated discussion forum where all members of a group are provided an opportunity to communicate. In this way there is full control over which users have access to which forum. Therapists can moderate forums by locking conversations and only allowing other therapists to write messages inside the forums, for example. Email notifications are sent out when a new message is added.

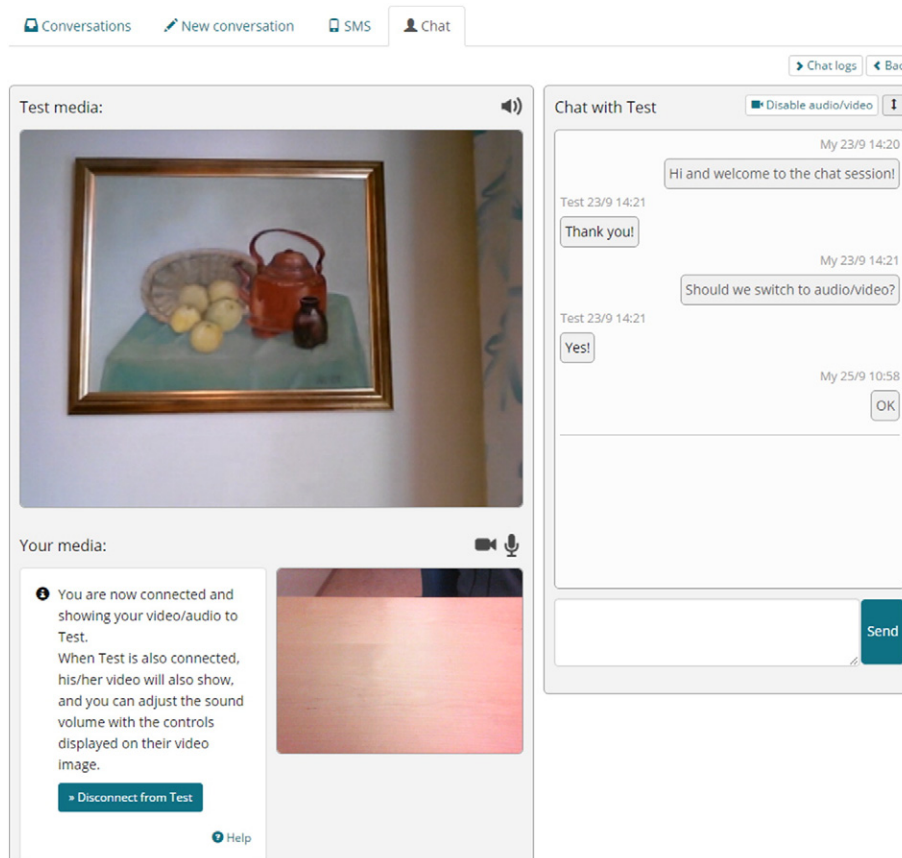


Fig. 2. An ongoing text chat and video conversation.

#### 4.5. Daily questions (EMA – Ecological Momentary Assessment)

The platform utilizes EMA (Ecological Momentary Assessment) questions, meaning that selected users may be assigned a question or set of questions sent to them daily via email or SMS. Questions provided daily (and at random times) may offer an improved assessment of behaviour or mood in the real-world as well as an understanding of temporal relationships among variables (Heron and Smyth, 2011). The questions page sent to patients is intended to be simple and rapid to complete with mobile-friendly sliders, as shown in Fig. 3.

#### 4.6. Questionnaire section

The platform has a capable questionnaire creation and data collection system built-in. Usually platform administrators quickly create questionnaires using existing templates and provided questions, or use information received from therapists, but the system is user-friendly enough that many therapists can edit the questionnaires themselves. The questionnaire layouts provided are similar to other pages displayed on the platform. We present in Supplemental Fig. VII how a typical questionnaire appears to the user.

The platform allows display of both individual answers that a user has given up to that moment, as well as a graphical representation of changes in pre-defined variables over time for that specific user. An example is presented in Fig. 4. Formulas can be defined for each page in a questionnaire, and the platform automatically calculates points from answers provided by each user. This data can be conveniently exported into Excel files for direct use in external statistical programs (e.g. SPSS and R).

Questionnaires can be automatically assigned to users (e.g. the screening questionnaire immediately after registration), or manually assigned by therapists during or after the treatment. When questionnaires are assigned to users, a start date is specified. This

The screenshot shows a mobile application interface for daily questions. At the top, there is a home icon and a menu icon. Below that, the word "DAY" is displayed in large blue letters with a red brushstroke effect. Underneath, it says "On a scale 1-10 from low to high...". The first question is "How is your mood right now?" with a slider set to 8. Below the slider are two smiley face icons, one sad and one happy. The second question is "How did you sleep tonight?" with a slider set to 3. The third question is "How much do you worry about things at the moment?" with a slider set to 3. The fourth question is "How good do you feel about yourself right now?" with a slider set to 3. At the bottom left, there is a "Send" button with a right-pointing arrow.

Fig. 3. Screenshot of the daily questions (EMA) as shown to the user on a mobile phone; answers are submitted through the use of mobile-friendly sliders.

is the day when an email with the invitation and link to the questionnaire is sent to the user.

Reminders are delivered automatically by the system to users that have not yet answered the questionnaires, usually the first three days following assignment, but this may be adjusted for each study. Both the invitation and reminder to complete the questionnaire may be sent out to users either by email or SMS, according to the preference of the therapist. Meta-data including date of questionnaire assignment, number of reminders and time of questionnaire completion are stored by the platform and included in the downloadable questionnaire data.

### 5. The administrative section

This section contains the pages where therapists can review all patient and other user information on the platform. This includes answers to questionnaires, including a graphical representation of change in measurements responses, answers to worksheets, progress within modules, activity logs, and the patient journal entries described below.

From the administrative section a listing of all users on the platform can be accessed as well as a view of all groups created on the platform (as described below; Fig. 5). The list shows a quick overview of each user and can be sorted to identify a particular username or set of properties.

#### 5.1. Patient journal/user log

A user log is provided to therapists and administrators and can serve as a complete journal for each participant. The user logs contains automatically recorded actions, such as logins, when modules were assigned and when questionnaires were answered etc. They may also include text entries manually added by the therapists for each patient, for example short entries, "Call this user after 18:00" or "The user has been included", or more elaborated entries related to the treatment.

#### 5.2. Questionnaire roadmaps

A roadmap is a list of questionnaires and times when they should be assigned to participants. It only needs to be assigned once to a user and then the platform will automatically send out the questionnaires and reminders according to a roadmap timeline (e.g. every week in the case of a roadmap with weekly measurements). This feature allows full automation of questionnaires and only requires that therapists specify a start date for the treatment.

#### 5.3. User lists


On this page a number of operations may be performed quickly, and with multiple users at once (Supplemental Fig. VIII). These operations include assigning user roles, adding/removing user groups, assigning modules, assigning questionnaires or roadmaps, starting new conversations, and connecting users. Therapists can easily control the sections users have access to from the start screen through the use of roles. Roles unlock certain features on the platform and a registered user may have multiple "roles" assigned to them.

The *administrator role* gives full access to the platform, such as adding new users, assigning other users the admin role and editing usernames and email addresses of users.

The *therapist role* privileges the user to treat and communicate with participants. Users with this role are designated as therapists and have the ability to communicate with other participants via the internal messaging system. An additional *SMS-role* can be given to therapists enabling them to send SMS messages to participants.

The *editor role* provides a user the ability to edit pages in a treatment program. This role may be provided to a user to edit pages, worksheets, and treatment modules without being able to access patient data. The task of the editors is normally to assist the study with adding material

Start Menu Administrate Help My username Logout



Responses to questionnaires

- Overcoming Perfectionism - weekly (2015-06-08 08:35)
- Overcoming Perfectionism - weekly (2015-06-16 06:04)
- Overcoming Perfectionism - weekly (2015-06-22 07:40)
- Overcoming Perfectionism - weekly (2015-06-29 08:24)
- Overcoming Perfectionism - weekly (2015-07-06 07:45)
- Overcoming Perfectionism - weekly (2015-09-14 07:47)
- Overcoming Perfectionism - weekly (2015-09-21 09:09)
- Overcoming Perfectionism - weekly (2015-09-28 07:56)
- Overcoming Perfectionism - weekly (2015-10-05 07:53)
- Overcoming Perfectionism - weekly (2015-10-12 08:33)

Visualizations of responses to questionnaires

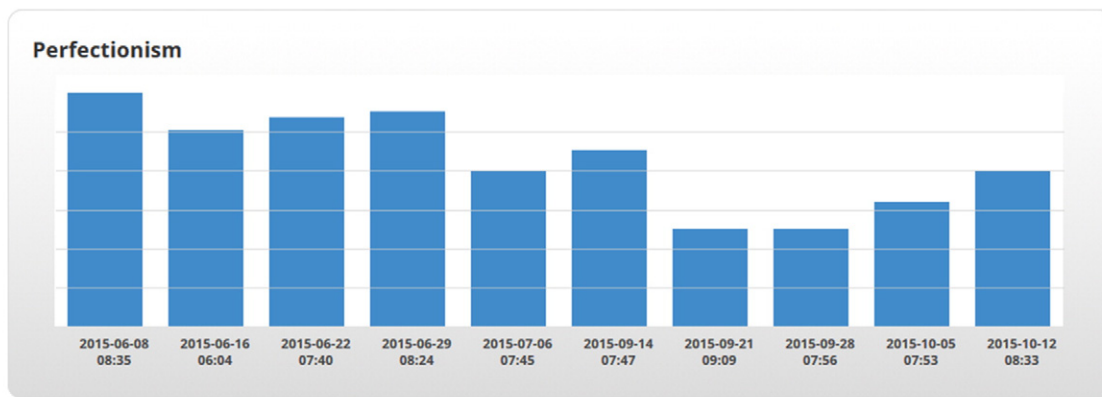



Fig. 4. The page with answers to a questionnaire from a study on perfectionism.

Start Menu Administrate Help My username Logout



Group: Validation study group

Search:  Show - All - rows per page

Username	E-mail address	Log text	Groups	Roles	Logins	Last login
1234dcba	[Redacted]	Phoned, eligibility confirmed	Validation study group	login, program, worksheet	45	2015-11-30 13:38:49
1061adgs	[Redacted]	Phoned. Eligibility confirmed.	Validation study group	login, program, worksheet	23	2015-11-29 13:57:59
2345uyrt	[Redacted]	Phoned. Correct number received by email today. Eligibility confirmed.	Validation study group	login, program, worksheet	41	2015-11-29 13:29:21

Fig. 5. The list of users, as shown on a group page. Please note the display of the last manual entry in each patient journal, a feature implemented at the request of many therapists so they could quickly review the current status of a user.

(public pages, treatment modules etc.) but most of the time the therapists themselves fulfill this task on their own, allowing them to be in full control of the website content.

Participants on the platform can be provided a number of roles specific to them. *The program role* provides a user the ability to see and access the treatment program inside the platform and to read treatment modules that are assigned to them. Not all participants are given this role, for example a participant in a control group is not given access to the treatment during the control phase. *A worksheet role* provides access to worksheets and *a forum role* access to discussion forums. Finally, a *login role* is required by users to log into the platform. This role may be used after the screening phase of a study when participant responses are still being analyzed by research staff and they have not yet been included in the treatment. When this role is given, an email containing a link to set or change the password is sent to the user.

#### 5.4. Groups

Groups are used to help the therapist categorize participants to ensure optimal treatment and attention. For example, each therapist may define a group that only contains their own participants, a group that contains all control group participants, or to help organize which therapist takes which participant. Any number of groups may be created, and a user may be a member in more than one. At any time a user may be added to or removed from a group.

#### 5.5. User hub

The “hub” is a section of the platform accessible to therapists by clicking on a username and contains all information about that individual user (Supplemental Fig. IX). In the hub, specific types of data are grouped by tabs. The *user details* tab shows contact information (the email address is blinded to prevent third-party viewing), the user roles, groups, logins, journal entries and quick scores for the screening questionnaire. The *questionnaires* tab provides detailed answers and user scores for each sub-questionnaire (Supplemental Fig. X). Entries may be added to the user’s log directly from this page because many diagnostics and observations are based on the user’s answers to questionnaires. The *questionnaire roadmap* tab provides a list of all questionnaire assignments for a user in sequential order, with the ability to interrupt a roadmap when needed (e.g. stop the weekly measurements when a user drops off treatment). The *visualizations* tab provides a graphical representation of change in the user’s scores throughout treatment, similar to Fig. 4. A *modules* tab provides a page for the therapist to assign new modules and see if the user has actually opened the module. Similarly, the *worksheets* tab provides a list of worksheets that have been assigned to that user, indicates whether the worksheet has been answered or not, and also displays the actual answers. A quick link is included here to allow the therapist to give feedback to the user based on their responses (Supplemental Fig. XI). A *daily questions* (EMA – Ecological Momentary Assessment) tab provides therapists the ability to both control the assignment of the daily questions to the user (time period, delivery method – email or SMS, etc.) and review their answers, including a graphical representation of changes in daily mood (Supplemental Fig. XII).

#### 6. Security

The security features built into the Iterapi platform are described towards the end of this paper but their importance is paramount. Psychological problems are highly stigmatized in society and patients require more than common security practices to ensure their privacy online (Elhai and Frueh, 2016).

The security features built into the Iterapi platform range from physical infrastructure to the software systems imposed by the data security authority in Sweden (*Datainspektionen*). Similar requirements are used

in other countries (Bennett et al., 2010; Kayrouz et al., 2014). In regards to physical infrastructure, the platform is installed on servers that are physically located on the premises of Linköping University, and servers are in a locked server room where only authorized technicians have access with cards and keys. A dedicated section of IT-technicians at the University make sure that the hardware equipment (servers and network) are constantly running and are redundant, having multiple hardware backups to ensure continuity if one system fails. Full software backups are taken daily and reside in a different building than the live servers and are encrypted with a key that only two administrators have access to.

The platform currently has two dedicated IT-administrators/developers assigned to its functioning and these individuals are part of a larger professional unit at the IT department of the University. This unit also includes a dedicated team of security experts, apart from the platform developers, that inspect and make sure that government-level quality assurance methods are in place for all services provided.

Treatments are run in isolation from each other. Each treatment has its own individual website, URL address and layout. This means that the therapists may only access the data of their own patients, inside the respective study or treatment. The study websites use a common set of functions, but the individual study data is isolated from each other in two ways: (1) each study uses and has access only to its own database where only the data for that study is stored; and (2) the information in the database is encrypted using the Rijndael 256 algorithm (Daemen and Rijmen, 1999), with a separate key for each study, that only the scripts from that study have access to. It is not possible to establish a relationship between the encrypted data on the platform and individual users by simply accessing the database.

The server operating system is Linux-based and the OS installation is dedicated only to the platform services. All data communication between the servers and the users, as well as peer-to-peer audio/video chat, take place via encrypted (https/TLS) protocols. Two-factor authentication (login) is used during all entries onto the platform, a process using generated usernames and passwords followed by a one-time SMS code sent to the user’s mobile phone. All communication related to the treatment takes place within the platform, so no confidential information is sent unencrypted via email.

#### 7. Challenges and further developments

Due to extensive experience running studies on the platform and the many years of continuous iteration, common problems found in running web-based studies and treatments have largely been resolved. Still, there are specific challenges due to future development of the platform and recently addressed issues that are worthwhile sharing.

One of the main complaints from the participants is the complexity of the login process when using two-factor authentication (password + one-time SMS codes), but this cannot be avoided or simplified without compromising the immense security precautions required by the healthcare regulations (Bennett et al., 2010).

The ability to have automated weekly measurements using questionnaires is an important tool for the therapists in order to follow the progress of their participants, both from a statistical point of view, and to allow for quick changes in treatment plans. Given their repetitiveness, however, they may become unattractive to some participants who may decide to skip them. For this reason, a functionality that allows for the logging of users’ questionnaire completion status, and sending of reminders to fill in measurements, both by email and SMS message was developed (Andersson, 2014).

The reminder-feature has helped increase the number of collected answers from participants (Titov et al., 2013). It was observed that when reminders were initially sent manually that participants would return answers within a few hours following receipt. Therefore it was decided to make the reminder system automated to reduce

therapist workload and continue to send a message until a response was received.

Based on feedback from therapists, a new warning system will be implemented that sends an alert to a therapist when a participant gives concerning answers to certain questions, e.g. a positive answer to a question about suicide. This system will be fully configurable, with the ability to choose which questions and what answers are to be considered alarming, as well as the therapist's preferred means of receiving a warnings (i.e. by email or SMS and receiving alerts one at a time as they come up, or gathering them all together).

One drawback to the video conversation solution at the present moment (summer 2016) is that Apple mobile devices (iPhone, iPod, and iPad) do not currently support the feature in their browser. Apple has recently listed the WebRTC components as "under development" so it is likely that this drawback will soon be eliminated. Nevertheless, the solution works well on all other devices and the drawback has not been an impediment to its use so far in the platform provided treatments.

As mentioned earlier, video conversations may become a more useful feature if therapists have the ability to record them. This is a complex feature that implies taking care of subsequent privacy issues and requires (among other technical things) a lot of storage space with the subsequent backups. Still, it is likely that development will begin on this feature in the near future.

Following the interest expressed by therapists, we also plan to implement group conversations both for text chats and video conversations using a so-called "group room" allowing the delivery of blended face-to-face and internet-based group therapy.

## 8. Conclusion

The Iterapi platform has been found to be effective in helping deliver solutions to improve quality-of-life for participants with psychological and behavioural health problems. Novel features are continuing to be added such as easy-to-use capabilities for video conversation, nevertheless many of these features are not straightforward to implement, and technological developments (such as web browser capabilities) can pose difficulties to their roll-out. Security of the system is a central focus of design requiring a significant portion of resources allocated for development and administration.

Online delivery of psychological and medical interventions is an increasing focus of academic and treatment communities. The Iterapi platform has been used in studies across many countries, but there will continue to be challenges making it a system that is universally available. For example, implementing a full multi-language solution, including right-to-left languages, has required an extensive re-working of the platform layout by the development team and close collaboration with technician colleagues from other countries.

In order to create such a solution and to continue providing novel features to extend platform functionality, feedback from the research and user communities will continue to be sought.

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