Research Forum

An E-Platform for Rehabilitation of Persons With Hearing Problems

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Purpose: The aim of this research forum article was to describe a feasible web-based solution for improving the quality of life of persons with hearing problems, such as hearing loss or tinnitus. The online platform was developed at the Department of Behavioural Sciences and Learning at Linköping University, Sweden, and has been running for a number of years and used in numerous studies and treatments.

Method: The security aspects of the platform as well as the process flow for running a study or treatment are described, focusing primarily on the technical and practical considerations. Also presented are the design characteristics and the main features and functions available in the platform.

Results: We point out the many advantages of running Internet-assisted intervention treatments, the challenges that we have faced, and some intended developments. Many of our research colleagues, both from Sweden and other countries, have already implemented or intend to implement their own studies on this platform.

Conclusions: Audiological rehabilitation can be delivered via the Internet using a stable online platform. Security and usability are important factors to have in mind for the design as well as adaptability to the patients. A next development step is to implement and test blended treatments using video conferencing inside the platform.

The Internet and modern information technology have had a major impact on health care, including the field of audiology. There is a growing number of studies in which the Internet is used in audiological research as well as in rehabilitation of persons with hearing problems (Swanepoel & Hall, 2010).

At the Department of Behavioural Sciences and Learning at Linköping University, Sweden, we have conducted many studies and treatments that have been found to improve quality of life of persons with psychological problems (such as depression, anxiety, and more) as well as with hearing problems, such as hearing loss (Thorén, Öberg, Wänström, Andersson, & Lunner, 2014) and tinnitus (Hesser et al., 2012).

One of the methods used in our studies and treatments is guided self-help via an in-house developed, web-based treatment platform, with which patients interact with therapists in a secure way and also perform a number of actions as part of their treatment: They read specific treatment modules, answer questionnaires, do interactive homework, watch videos, listen to audio files, and complete other tasks (Andersson, 2014). There are other presentations on how to develop and implement Internet interventions (e.g., Yardley, Morrison, Bradbury, & Muller, 2015); however, in this research forum article, we focus on presenting our approach to Internet interventions by shortly describing the technical functionality of the platform, the process flow, and some of the key features that have proven very useful in e-treatments on the basis of our long experience starting from 1998. We also present encountered issues and give our considerations on the security and the treatment process.

Design and Security

The platform has been designed having in mind all the security requirements for online treatments, from the physical infrastructure to the software development. These requirements in Sweden are quite similar to the ones in other countries (Bennett, Bennett, & Griffiths, 2010; Kayrouz et al., 2014):

- The platform is installed on servers that are located in the premises of Linköping University.
- The servers are placed in a locked computer room that can only be accessed by authorized personnel using cards and keys.
- All sensitive data are stored encrypted in the database (using algorithms such as hmac/sha256/secret keys).

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and it is not possible to establish a relationship between these data and individual users by getting access to the database.

- All data communication between the servers and the users that takes place is encrypted (via https), and a two-step login process is used: random user code and password + one-time short message service (SMS) codes sent to the user’s mobile phone.
- All the communication related to the treatment takes place inside the platform, so no confidential information is sent unencrypted via e-mail.
- The software on the servers is constantly updated, as the platform administrators are part of a bigger professional team at the Information Technology (IT) department of the university.
- The layout is responsive so that the pages are easy to read on all mobile devices.
- The software allows easy adaptation to treatments in different languages; in fact, studies on the platform have been already run in a number of countries and languages (e.g., Sweden, Romania, Germany, a Kurdish version in Sweden, a planned study in the United Kingdom).

**The Content on the Platform**

The actual treatment modules, questionnaires, homework, and media files used on the platform are developed by professionals in their respective fields: researchers, clinicians, and specialists in the respective domain (e.g., psychological conditions or hearing impairments). The treatment modules can be presented in various formats: web page text and images, PDF files, as well as video or audio files—either linked or produced in-house and embedded in the pages. The platform developers also adapt the contents for specific cases; for example, in treatments for patients with hearing impairments, it is possible to have the volume of the embedded media files higher by default and easy to adjust.

**The Process Flow**

The typical process flow when running a treatment on the platform is presented in the diagram in Figure 1. We mention below a few of the many features on the platform: The IT administrators of the platform help the therapists during both the preparation and the implementation, but usually a 1-hr walk-through session with the therapists is more than enough for them to be able to easily use all the features on the platform. For the patients, the platform is very easy to use and self-taught, and their constant communication with the therapists during the treatment is a quick method to facilitate the use of the platform.

Each study or treatment can have its own URL and its own personalized design with different logos, colors, and layout. The website for a study consists of two parts: a public part used to present the study to all visitors and a private part in which the users arrive after logging into their account.

The therapists themselves can easily add and edit content on the platform (both public content and treatment modules), thus allowing for a quick set up of the platform. We can mention here that some of the existing content (modules, questionnaires) can be reused across different studies and treatments.

If the process is a research study, then, when the registration process opens, the patients can register their e-mail address on the website, agree with the terms of the study and the handling of the personal data, and also fill in a screening questionnaire that will be analyzed by the therapists to verify whether the respective patients are eligible for the treatment. In the case of a research study, the selected participants are then randomized via a separate randomization website into groups on the platform, and then the actual treatment phase begins:

- The therapists assign treatment materials (modules) to patients, usually at the beginning of every week during the treatment.
- As an option, they assign homework to patients.
- Conversations, either in private or in group forums, take place on the secure platform between therapists and patients.
- The patients are assigned measurement questionnaires, either on a predefined schedule (e.g., automated weekly survey roadmaps) or manually for certain special cases. The patients will receive automatic notifications to answer the questionnaires. Scores are automatically computed on the basis of the answers.
Therapists can view directly on the platform, in a text or graphical view, different types of responses and computed scores for the patients as well as worksheets, conversations, and activity logs.

Data may be seen both on screen as well as exported into advanced customized Excel files that can be easily further processed and analyzed by the therapists.

Having in mind that self-help studies may be considered tedious by some patients, we try to keep the platform as easy to use as possible. For example, we designed the pages to be easy to read, use stimulating interactive homework whenever possible, and give the therapists functionality to allow them to easily follow the progress and actions of the patients and quickly give them feedback when needed.

Just to give a quick impression of what the platform pages look like, we show here two example screenshots taking from a study about Internet-delivered acceptance and commitment therapy for treating the psychological effects of hearing loss (see Figures 2 and 3).

Some Issues and How We Dealt With Them

As with other platforms of this kind, one of the main complaints from the users remains the complexity of the login process when using a two-step authentication process (password + one-time SMS codes). However, this could not be avoided or simplified without losing the strictness required by the health care regulations (Bennett et al., 2010).

The automated weekly measurements using questionnaires are an important tool for the therapists to follow the progress of the patients. However, given their repetitiveness, this can be unattractive to some of the patients who choose to skip answering for a certain week. That is why we have included some functionality that allows logging and sending reminders for filling in measurements, both by e-mail and SMS messages when needed (Andersson, 2014). This reminder feature has definitely helped increase the number of collected answers from the abovementioned patients.

Another observation is that sometimes a few patients might need assistance with either small technical issues or questions about content, but this is handled via the dialog with the therapists on the platform. Furthermore, the functionality of the platform is constantly updated on the basis of feedback from therapists (either their own suggestions or indirectly from the patients’ suggestions), and different features can be activated only for certain treatments to which they are better fitted. Examples of such features include enabling/disabling the usage of live chat, automatically assigning (or not assigning) new treatment modules after completing certain homework, allowing changing of existing answers for saved homework, and increasing the default volume level of audio files in treatments of hearing problems.

Intended Development

We can mention here the desirable introduction to the platform of text chat and one-to-one video conversations between therapists and patients, allowing for blended treatments in which face-to-face sessions and information technology are combined (Månsson, Ruiz, Gervind, Dahlin, & Andersson, 2013). These conversations will take place in...
a user-friendly way, completely embedded in the platform pages, inside the web browser (via the encrypted WebRTC technique), avoiding using a third-party solution for text/audio/video chat that would require much more complex administration. At this moment, this development is in its testing phase and has been working very well so far.

Conclusions

After a long experience with treatments on the platform, we have found its usage to be very successful in improving life quality for patients with psychological problems and hearing impairments. The security of the platform is an important thing to have in mind for the design, requiring an important part of the resources allocated for development and administration, both financially and time-wise. Some aspects of using the platform still prove challenging for some patients, so attention has to be kept on creating attractive content and simplified procedures for all operations. One-to-one video conversations included on the platform will prove to be an important addition in this aspect as well as in implementing blended treatments.

References


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