Integration of Data-Driven Analysis in the Usability Evaluation of Internet Interventions for Mental Health Care

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ABSTRACT
This study identifies types of patient-generated data that can be considered in the usability evaluation of internet interventions for mental health care. The paper discusses how we can leverage patient-generated data within the scope of an internet-based cognitive remediation program developed for residual symptoms in depression treatment based on the person-based approach. The study proposes a model of data and discusses how we can use a data-driven analysis for usability evaluation in the internet intervention.

Author Keywords
Data-driven analysis; usability evaluation; internet intervention; cognitive remediation; patient-generated data; person-based approach.

ACM Classification Keywords
H.5.2. Human factors.

INTRODUCTION
Depression is one of the most common mental health disorders affecting millions of people around the world [7]. Cognitive impairment is a core symptom of depression and may remain as residual symptoms, such as attention-, memory- and executive deficits, after the main symptom is treated. Experiencing cognitive residual symptoms could negatively affect daily functioning and be a risk factor for developing new episodes of depression.

There has recently been a growing tendency to provide cognitive remediation programs using online therapy. However, the extent to which internet-based cognitive remediation programs are able to meet patient expectations and needs by evaluating their usability can be expected to impact the effectiveness of such programs.

Studies conducted for this purpose include the evaluation of either patients alone [3], or both patients and experts in the field [6]. However, patient-generated data [11] during the use of such programs shows that user research for programs can be performed not only by patient and expert feedback, but also by data-driven analysis.

Therefore, internet-based cognitive remediation programs, whether undertaken based on a user-centered design [9], an interactive multistage process [8], or a person-based approach [5], can provide valuable information concerning the analysis of patient-generated data for usability evaluation.

This position paper demonstrates the types of patient-generated data that can be utilized in usability evaluation for an internet-based cognitive remediation program developed for depression treatment based on the person-based approach. The person-based approach offers guidance for the development of more effective and efficient interventions for individuals [10].

BACKGROUND
There are a few numbers of studies conducting user research basing on data-driven analysis to understand effectiveness of online mental health programs.

For example, Dirmaier et al. [2] performed a user analysis, through Google Analytics, of a mental health portal they developed by reviewing data over 18 months. The authors evaluated usage frequency, usage trends, and user loyalty. Similarly, Ashton et al. [1] used Google Analytics and YouTube Analytics to conduct a user analysis on a web-based health-lifestyle program called HEYMAN. They examined the frequency of users visiting the pages included in the program and the data on the videos that the users watched.

It is possible to conduct data-driven analysis not only in web-based programs, but also in health programs designed for mobile platforms. Matthews et al. [4] prepared a study protocol, in which they stated that they were planning to undertake a user-oriented feasibility study of the “HelpMeDoIt!” mobile health program based on analytics data.

PATIENT-GENERATED DATA IN DATA-DRIVEN ANALYSIS
Patient-generated data is defined as “health-related data created, recorded, or gathered by patients (or by family members or other caregivers) to help address their health
concerns” [11]. We categorized the patient-generated data which can be collected from the internet-based cognitive remediation program mentioned in this study into five groups; usage, content, performance, interaction, and feedback (Figure 1).

Usage data comprises information on user login, sessions, and location (recorded for mobile applications with the consent of users). This helps determine the timeframe, frequency and location of access to the application, and calculate the total time a patient is actively using the application.

Content-related data consists of program-, module- and task-based information. Patient interaction with content elements provide information on the analysis of the completion of activities related to text, video or image content or the time taken to complete a given survey.

![Figure 1. Categories of patient-generated data that can be used in data-driven analysis.](image)

Evaluation of the performance and improvement of patients during the use of a program is valuable in terms of offering an insight into whether the content, program or the targeted treatment will be successful. These evaluations may differ according to the purpose of the program to be implemented. However, it is possible to obtain information about the performance and improvement of patients through tests, tasks, and assignments to be included in the program.

The communication of patients with other people who use the same program or with therapists provide an understanding of their interactions within the program. In addition, details, such as the time, frequency and content of these interactions can be used to assess how effectively the program is used.

Finally, the opinions and suggestions elicited from patients provide a wide range of feedback from the usability of the program to the content of the program implemented.

INTEGRATION OF DATA-DRIVEN ANALYSIS INTO THE PERSON-BASED APPROACH

The person-based approach proposes the development of digital health interventions in four distinct stages; (1) planning, (2) design, (3) development and evaluation of acceptability and feasibility, and (4) implementation and trialing [10]. In the person-based approach, usability evaluation is undertaken based on qualitative research with target audience throughout development and evaluation of acceptability and feasibility stage [10]. In this paper, we explore how to supplement the person-based approach with data-driven analysis in usability evaluation.

One part of usability evaluation will involve user and expert feedback throughout intervention development (Stage 3) and implementation (Stage 4) while the other will comprise the analysis of both quantitative and qualitative patient-generated data stored in the program (Stage 3 and 4). This positively overlaps with the main goal of the original person-based approach; the development of successful digital health interventions [10].

To explain in more detail, in the third stage of the person-based approach (development and evaluation of acceptability and feasibility), the assessment of the defined and designed usability tests together with patient-generated data obtained from data-driven analysis can contribute to the success of studies to be undertaken in the next stage. In the last stage (implementation and trialing), the patient-generated data obtained during actual use of the developed programs can help the improvement of the program for later use.

We consider that the integration of data-driven analyses into the usability evaluation of internet-based cognitive remediation programs will provide enriched data and support the process of identifying user expectations and needs related to both treatment and program. It can provide valuable data to main stakeholders of the treatment program, namely patient, therapist and designer.

Designers can get benefit from data-driven analysis to improve usability of the program. This can increase satisfaction of patients and can help therapists to deliver treatment effectively. Information can also be displayed and easily accessed through a dashboard derived from patient-generated data, both patients and therapists can monitor the progress about the treatment.

DISCUSSION AND FUTURE WORK

The internet-based cognitive remediation program mentioned in this study is currently in the "development and evaluation of acceptability and feasibility" stage of the enriched person-based approach.

It is planned to undertake usability studies of the program with patients, and experts (together with quantitative patient-generated data obtained) in this stage and later perform a data-driven analysis based on the sampled data in the “implementation and trialing” stage.

This position paper addresses several relevant themes for the workshop, in that our case provides an example of an approach to evaluate the usability of internet interventions for mental health care. Person-based approach is explicitly concerned with including and understanding user needs, and
we have looked specifically on the evaluation challenges of how we can integrate data-driven analysis in this process.

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