

# E-Mental Health: Contributions, Challenges, and Research Opportunities from a Computer Science Perspective

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## INTRODUCTION

E-mental health is the fusion of computer science and mental health, where the computer science aims at supporting the work of the physicians. It is a recently emerged research field that utilizes information and communication technologies to support and improve mental health. Furthermore, it is an interdisciplinary research topic that contributes to the welfare of society. The use of social media, online and smartphone applications helps to close the large gap between the need and actual treatment for mental disorders (Kohn, 2004). In addition, it aims at the reduction of costs for the society that arises from the direct treatment and the indirect costs, due to the loss of productivity or even the workplace (Fiscal, 2005; Harwood, 2000).

E-Mental health inherits the problems and benefits of clinical mental health, and many research results from mental health also apply to e-mental health. Interventions, screening and assessment for the treatment of mental disorders can effectively be delivered with Internet-based software. The adherence in therapy and dropout are problems that are linked to the design and implementation of the e-mental health software as well as the provided treatments and interactions with the guiding therapist. Therefore, the development of these applications requires guidelines to guarantee its quality and success.

During the process of treatment, a huge amount of data is collected that contain information that can be unraveled with data mining. Data mining algorithms are useful for the support of the physicians work, because it can provide predictions of the client's recovery based on previous patients. In addition, it can be used to extract the mood of the client from written text or record the activity profile using a mobile phone. Despite the amount of conducted research many questions are still unanswered. Accordingly, this chapter discusses the contribution of computer science to e-mental health, and suggest directions for further research.

## FROM COMPUTERIZED THERAPY TO MACHINE LEARNING

The efficacy of a computerized cognitive behavioural therapy were demonstrated (McCrone, 2004), and online interventions are proven effective for a variety of different mental diseases such as depression (De Graaf et al., 2009), anxiety (Andrews, Cuijpers, Craske, McEvoy & Titov, 2010), eating disorders (Dölemeyer, Tietjen, Kersting & Wagner 2013) and they can be used to improve the medication adherence (Linn, Vervloet, Dijk, Smit & Van Weert 2011).

In the beginning of e-mental health the quality and success of the e-mental health applications were questionable, because this field was lacking of development and style guides, which led to a variety of different applications with low user adherence and the results were hardly comparable. This was mostly

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due to the lack of user involvement in the design of e-mental health applications and missing collaboration between software developers and health service researchers (Pagliari, 2007).

Another major concern was the usability and safety of the clients. The potential of medical errors within the applications has to be minimized, to increase the client's safety. This goal goes hand in hand with the usability of the software and adherence in therapy, because a user unfriendly software can lead to rejection by the customer and is prone to possible medical mistakes (Karsh, 2004). Nowadays still privacy concerns and doubt about the effectiveness of online treatment remain barriers for many patients (Musiat et al., 2014).

Besides the early troubles, currently, many commercial treatment offers exist and even more research studies are conducted within this field. Additionally, many countries invested significantly into the eHealth sector, which enforced the need for development guidelines. This led raise to different proposed frameworks. The suggested frameworks are aiming at including the clients, medical researchers and stakeholders into the development of the application, to improve the impact and the integration in the health sector (Van Gemert-Pijnen et al., 2013).

Apart from the development of software, the conduction of research studies in this field is under research and about to change. The online technologies develop that quickly, that there is the possibility that when a result of a randomized trial is published, the newly studied intervention is already dated and unappealing. To prevent that clients use outdated interventions that are less effective, suggestions to speed up and improve the impact of studies were made (Baker, Gustafson & Shah, 2014).

Another problem within online treatment is early drop-out of therapy. Ineffective treatments or a lack of usability are reasons for a client to drop out of therapy, which endangers their remission. The dropout rate in mental health is a severe problem because the adherence of the clients to the therapy is essential for their remission, and the same applies to e-mental health. The adherence to computerized treatment is even significantly lower than regular treatment (So et al., 2013), and the dropout rate in e-mental health is even higher compared to regular face to face treatment (Melville, Casey & Kavanagh, 2010). This poses challenges on e-mental health, that are yet to research and conquer (Stegemann, Weg, Ebenfeld & Thiart 2012).

Ways to keep the client engaged in the online therapy are under research and fundamental for the success of e-mental health and the remission of the client symptoms. The use of a simple monthly reminder email has already shown to improve the maintenance in therapy (Gill, Contreras, Muñoz & Leykin, 2014). Since mobile phones are widely used and integrated into daily life, mobile applications are extremely useful to deliver mental-health service directly to the customer.

The use of an SMS or a reminder function can also increase the adherence to the therapeutic application and increase the engagement in the overall therapy (Whittaker, Borland & Bullen, 2009). Another benefit of using mobile applications is that they are steadily available. Especially disorders where the symptoms can appear quickly like anxiety, panic disorder or nicotine dependence can be treated effectively with mobile applications because the applications can be used whenever they are needed.

Therapeutic mobile phone applications can also be delivered as a game. The process of transforming an medical interventions into a game is called gamification. Within the gamification of an intervention, the interventions are modified in a way that they require interactions typically found in games. A recent study demonstrated that gamification of an attention-bias modification training leads to reduction of stress and anxiety (Dennis & O'Toole, 2014). Although, the effect of serious games has already been researched, there is still a lack of serious games for additional treatment of mental disorders (Fernández-Aranda et al., 2012). This is a new area of research, where the effectiveness has initially been demonstrated, but the topic still requires more research and still poses unanswered questions.

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