



What is the Current and Future Status of Digital Mental Health Interventions?

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Abstract. The prevalence of mental disorders continues to increase, especially with the advent of the COVID-19 pandemic. Although we have evidence-based psychological treatments to address these conditions, most people encounter some barriers to receiving this help (e.g., stigma, geographical or time limitations). Digital mental health interventions (e.g., Internet-based interventions, smartphone apps, mixed realities -virtual and augmented reality) provide an opportunity to improve accessibility to these treatments. This article summarizes the main contributions of the different types of digital mental health solutions. It analyzes their limitations (e.g., drop-out rates, lack of engagement, lack of personalization, lack of cultural adaptations) and showcases the latest sophisticated and innovative technological advances under the umbrella of precision medicine (e.g., digital phenotyping, chatbots, or conversational agents). Finally, future challenges related to the need for real world implementation of these interventions, the use of predictive methodology, and hybrid models of care in clinical practice, among others, are discussed.

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There is a growing consensus in today's society about the urgent need to pay more attention to mental health. The pandemic caused by COVID-19, among other factors, has highlighted the existing gaps in our health care, and especially in the resources available to deal with health problems. Almost one in five adults suffer from a mental disorder at some time in their life (Steel et al., 2014). Although evidence-based psychological treatments are available for the general population, access to them remains difficult (Henderson et al., 2013; Thyloth et al., 2016). In addition to the investment and resource problems

and lack of available services noted above, other problems include stigma, difficulty affording services, and geographical or time limitations (Harvey & Gumpert, 2015). Adaptations and translation of psychological interventions to digital formats, called digital mental health interventions (DMHIs), has the potential to overcome some of these barriers by facilitating access to psychological support and resources and improving the efficacy, effectiveness, and efficiency of psychological interventions.

This article aims to summarize the most relevant contributions made in recent decades, focusing mainly on the use of DMHIs for the psychological treatment of the most prevalent mental disorders. First, we will describe the different options that currently exist for dispensing interventions digitally. Second, we will analyze their limitations and try to show the technological advances toward a better comprehension of mental disorders through precision medicine. Third, we will try to envisage the future and the challenges it will bring in the short and medium term. Finally, the main conclusions will be summarized.

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Digital Mental Health Interventions (DMHIs)

In the past 30 years, the scope of DMHIs for the delivery of mental health services has evolved exponentially, ranging from the framework of “eHealth”, through telemedicine or Internet-based interventions (IBIs; Ritterband et al., 2006), to “mHealth”, through mobile digital interventions such as smartphones or virtual or augmented reality applications (Miralles et al., 2020; Price et al., 2014; Wiederhold, 2015). Currently, and given the demand for mental health resources during the COVID-19 pandemic, all of these digital solutions have received particular interest because of the opportunities they provide in terms of accessibility, cost-effectiveness, personalization, and attractiveness (Balcombe & De Leo, 2021).

Next, we provide a review of the main DMHIs. In particular, we first focus on IBIs and then on other innovative approaches, such as smartphone apps, virtual reality (VR), and augmented reality (AR).

Internet-based Interventions (IBIs)

To date, IBIs are one of the most studied DMHIs. IBIs can be defined as therapeutic programs with specific objectives conveyed through modules or lessons delivered via the Internet by computer or mobile phone (Andersson & Titov, 2014; Barak et al., 2008). There are many varieties of IBIs. Some of them are fully automated and independent of human support (self-guided or unguided interventions), and others are automated but accompanied by contact with the therapist or technician (guided interventions) (Andersson, 2009). Their efficacy may vary depending on the quantity or intensity (dose–response) and quality of the guidance (e.g., professionalism of the e-coaches and the type of communication employed).

Initial studies on guidance intensity and efficacy led to the conclusion that unguided IBIs were less effective than IBIs that included some guidance from a clinician (Baumeister et al., 2014; Richards & Richardson, 2012). However, an emerging body of literature indicates that the differences between guided and unguided IBIs are smaller than previously assumed or may even be non-existent (e.g., Königbauer et al., 2017; Mira et al., 2017). Promising alternatives that are receiving more attention and beginning to accumulate empirical evidence are guidance on demand, which combines the advantages of guided and unguided self-help IBIs (Rheker et al., 2015), and blended therapy, which is a combination of face-to-face therapy and online support (Erbe et al., 2017).

Evidence shows that IBIs can be as effective as traditional face-to-face therapy for a wide range of psychological disorders (Carlbring et al., 2018), and that they can be effective in promoting healthy behaviors (Allam et al., 2021; Webb et al., 2010) and preventing psychological problems (Sander et al., 2016). Specifically,

Internet-based cognitive-behavioral therapy (iCBT) stands out as the therapeutic approach that has received the most attention and evidence (Andersson, 2009).

Additionally, IBIs can directly take advantage of other innovative technologies, such as smartphone apps or virtual devices.

Smartphone Apps

In the past decade, smartphones have become part of life for most of the population (Bakker et al., 2016). About 3 billion people worldwide already use smartphones (Statista, 2019), and they are increasingly common in developing countries (Pearson et al., 2017). Their advantages include instant communications and access to resources from any geographic point through a simple, graphical, finger-based interface, thus eliminating the need to carry many devices, such as a camera or GPS system (Bauer et al., 2020). Some of the most common mHealth intervention strategies are apps. Through apps, it is possible to cover all the phases of psychological care, including prevention, diagnosis, treatment, combination with face-to-face therapy, and relapse prevention, among others (Chandrashekar, 2018).

Apps can be used as a psychological treatment in the form of momentary ecological assessment (EMA) or momentary ecological intervention (EMI) (McDevitt-Murphy et al., 2018). EMA is an evaluation system that allows data to be collected from participants in their natural environment at various time points. Generally, the app asks the participant to answer one or more questions several times a day or at random times. EMI follows a similar structure, but the contents can be reminders, feedback messages, or instructions for specific or important behaviors in psychotherapy. One type of EMI that will be very prominent in the future of clinical practice is “just-in-time adaptive interventions” (Nahum-Shani et al., 2018).

Regarding efficacy, the meta-analysis by Linardon et al. (2019) suggested that apps can be low-intensity, cost-effective, and easily accessible interventions for people who are unable to receive standard psychological treatment. Recently, Miralles et al. (2020) reported that most of the research conducted so far with apps has focused mainly on the most prevalent mental disorders, with less attention paid to the less prevalent or more severe disorders. Finally, evidence about treatment modalities delivered via apps (e.g., CBT, mindfulness) is currently limited (Huckvale et al., 2020).

Although many mHealth apps are available for immediate download on marketplaces, more randomized controlled trials (RCT) are needed to validate them (Miralles et al., 2020) and obtain more detailed information about dosage (Firth et al., 2018), duration of interventions (Boisseau et al., 2017), and long-term adherence (Paul & Eubanks Fleming, 2019). More efforts

are required from science, technology, and healthcare providers to ensure their regulation and make it possible for these tools to be administered appropriately for mental health treatment.

Mixed Realities: Virtual and Augmented Reality

In addition to IBIs and smartphones, other sophisticated technological tools such as VR and AR have also been successfully used for the assessment and treatment of mental disorders (Emmelkamp & Meyerbröcker, 2021).

VR can be defined as “a collection of technologies that allow people to interact efficiently with 3D computerized databases in real time using their natural senses and skills” (McCloy & Stone, 2001, p. 912), whereas AR “combines the real world with virtual elements, using computer graphics mixed with the real world in real time” (Botella et al., 2016, p. 2). Currently, the term “mixed realities” is preferred to refer to the combination of virtual and real worlds to create a unique experience.

Above all, VR has been used to implement exposure therapy, so that people can experience feared situations or stimuli in a controlled context without leaving or avoiding the clinical setting (Botella et al., 2017). However, its use has been extended beyond exposure, and it is useful for many other relevant tasks in psychological interventions, cognitive training, and emotional induction and regulation. To date, VR has been shown to be effective in the treatment of a wide range of psychological conditions (e.g., emotional disorders, psychosis, eating disorders) (Cieślak et al., 2020; Park et al., 2019). However, the methodological quality of most of the studies is low, and the use of VR beyond research laboratories has not been examined much (Freeman et al., 2017).

AR is an attractive tool because it allows people to immerse themselves in the real environment while experiencing stimuli that seem practically real. Thus far, AR has been used mostly in the fields of medicine (Eckert et al., 2019), training (Barsom et al., 2016), and rehabilitation (Williams et al., 2019), showing promising results. However, the application of AR in the field of clinical psychology is still limited and has focused mainly on the treatment of phobias (Vinci et al., 2020).

Both VR and AR are tools that have revolutionized the healthcare field due to their potential as: (a) Imaginal technology, allowing people to feel, “as if they were” in a reality that does not exist in the physical or real world; (b) embodied technology, allowing people to feel the user’s body inside the virtual environment; and (c) connectivity technology, allowing people to connect and share experiences with others from any geographical location. Currently, the VR field has evolved from simulating the world to simulating the self, and now to connecting people to build and have experiences

together, thus opening up a wide range of possibilities in the field of social networks.

As technology advances by leaps and bounds, the future of mixed realities will produce significant changes in both research and clinical practice.

Limitations of the Use of Digital Mental Health Interventions (DMHIs)

Although much of the literature points out that DMHIs are effective and useful tools for providing psychological support, there are some limitations that still hinder their application. Some of them are highlighted below.

First, adherence to DMHIs is a challenge for clinicians and researchers, given that a significant percentage of patients (20-50% approximately) stop using them and drop out of the treatment program before completing it (Lewis et al., 2020; Richards & Richardson, 2012; Torous et al., 2020).

Second, engagement in DMHIs remains an issue because it varies from one study to another and is usually lower in the real world than in the research context (Baumel et al., 2019). A recent systematic review found that user engagement is influenced by three factors related to: (a) User characteristics (e.g., severe mental health problems or advanced age); (b) user experience with the program or content, with users being less likely to engage if they do not perceive the program to be useful and personalized; and (c) technology and implementation environment, pointing to technical problems and lack of security (in terms of privacy and anonymity) as other barriers to engagement (Borghouts et al., 2021).

Third, to date there is little evidence that DMHIs can be successfully implemented in healthcare settings (Mohr et al., 2017). Although the feasibility of DMHIs has been demonstrated in the research context, few studies have confirmed their potential in clinical practice. One problem is that research has assumed that the technology itself is the main agent of change, while paying less attention to the ecosystem surrounding that technology (e.g., therapeutic support or organizational systems) (Mohr et al., 2017).

Fourth, the lack of digital health policies or legislation and the lack of accountability within the commercial sector have also influenced the population’s acceptance of DMHIs (Cummins & Schuller, 2020).

Fifth, the exponential use of DMHIs in health care as devices to collect data has raised many ethical questions (Wykes et al., 2019).

Sixth, the lack of RCTs and the wide variety of methodologies used in economic evaluations of DMHIs limit the generalizability of conclusions about their cost-effectiveness (Fodor et al., 2018; Kolovos et al., 2018).

Finally, there are still few studies on cultural adaptations of DMHIs (Jiménez-Molina et al., 2019). So far, most of the research has focused on analyzing their effectiveness in developed countries rather than in low- and middle-income countries (Meherali et al., 2021).

Towards Precision Medicine: Artificial Intelligence (AI) and DMHIs

As we have seen, technology is revolutionizing the way mental disorders are assessed, diagnosed, and treated. To date, it remains a challenge to provide: (a) Objective and reliable diagnosis; (b) real-time, actionable tracking of health data; (c) personalized treatment programs; and (d) ongoing psychological support (Lovejoy, 2019). In this regard, precision medicine and AI offer the opportunity to improve existing therapeutic barriers (Bickman, 2020).

Through AI-based technologies (e.g., machine learning, deep learning), which rely on the identification of specific patterns within multimodal and heterogeneous data sets (e.g., data from psychometric instruments, biomarkers, smartphones or social networks, e-stores, speech), it is possible to detect or prevent the occurrence of psychological problems in an objective and reliable way, thus changing the way clinicians perceive and understand mental disorders (Bickman, 2020).

The use of digital phenotyping, defined as the “*moment-by-moment quantification of the individual-level human phenotype in-situ using data from smartphones and other personal digital devices*” (Torous et al., 2016, p. 2), is changing the world of mental health care. More and more research is being conducted to analyze whether these data allow more accurate predictions in the prevention, treatment, and facilitation of support resources to promote motivation for self-management of health behavior (Radhakrishnan et al., 2020). Specifically, EMAs, via smartphone apps, appear to be a useful clinical tool, allowing healthcare professionals to build a digital phenotype (Lopez-Morinigo et al., 2021).

Other important advancements are coming from chatbots or conversational agents. Chatbots are computer programs which, through smartphone apps, enable text-based or voice-activated conversations with the human user, providing pre-programmed or AI-based responses (Adamopoulou & Moussiades, 2020). Numerous studies have shown that their effectiveness (especially those based on CBT) is comparable to that of face-to-face therapy (Bendig et al., 2019). Thus far, most chatbots have been used for therapy, training, and screening, and they have mostly focused on depression and autism (Abd-alrazaq et al., 2019). More studies are

needed to test their efficacy in a wide range of mental disorders.

In sum, the integration of AI in the healthcare sector is the key to improving the quality of existing mental health services. However, further research is needed to ensure its successful implementation and dissemination in the clinical and real worlds.

Future Challenges of Digital Mental Health Interventions (DMHIs)

The COVID-19 pandemic has accelerated the demand for psychological care services, providing a great opportunity to disseminate DMHIs (Balcombe & De Leo, 2021). However, there is still a long way to go until DMHIs are actually implemented in healthcare settings (Graham et al., 2020). In this regard, it is currently advisable to advocate models such as “Accelerated Creation-to-Sustainment”, whose aim is to sustainably develop and implement DMHIs in the real world (Mohr et al., 2017). In addition, it is a priority to integrate the strategies proposed in the Expert Recommendations for Change Implementation (ERIC) project to determine the factors that promote successful implementation of DMHIs, both in the research context and in real world settings (Graham et al., 2020).

Risk prediction in mental health is a challenge for clinical psychology. Precision and personalized medicine are leading the way to new forms of prevention in an attempt to reduce the burden of disease in the long term (Huys et al., 2016; Stewart & Davis, 2016). To date, it is still a priority to analyze the new possibilities of predictive methodology (e.g., Big Data) in routine clinical practice (Lawrie et al., 2019).

Another challenge to be addressed in the future is related to the need to train healthcare professionals in the use of DMHIs and develop therapeutic support protocols so that they are effective and attractive to users (Lattie et al., 2019; Mitchell & Kan, 2019). Future studies should explore the possibilities of digital training programs for clinicians (Fairburn & Patel, 2017).

A further challenge has to do with the implementation of hybrid models of care in clinical practice (Balcombe & De Leo, 2021). In this regard, the analysis of patient characteristics is essential in determining the type of psychological care to be delivered, considering the potential of DMHI, face-to-face therapy, or both formats.

The final challenge is to address the ethical issues raised by the use of DMHIs, keeping researchers, developers, users, and providers in mind. It is important for all the groups involved to know their responsibilities and establish frameworks for the development and ethical use of DMHIs (Wykes et al., 2019).

Conclusion

This article has reviewed the latest advances in different technological solutions for mental health treatment. Through DMHIs, it is possible to increase and facilitate access to evidence-based psychological treatments. Currently, there is a large body of accumulated evidence on the efficacy and efficiency of IBIs for many psychological problems. Until a few years ago, most IBIs were delivered via computer. However, in order to make IBIs more accessible and personalized, health professionals are becoming increasingly interested in the use of mobile phones or apps. Although several meta-analyses support the use of apps for the treatment of the most prevalent psychological disorders, there is still a need to investigate this approach in the rest of the mental disorders. Currently, “just-in-time” adaptive apps stand out as promising tools to provide more accessible and personalized psychological support. Finally, VR and AR technologies, which are now known as mixed realities, have become very useful tools in clinical psychology.

Despite the numerous advances in DMHIs, there are still a number of limitations that hinder their implementation and dissemination. Technological advancement is rapidly trying to overcome them with more optimal and innovative digital solutions through precision medicine along with AI-based technologies.

The advent of the COVID-19 pandemic has revolutionized and accelerated the course of DMHIs in healthcare provision. However, more research and policy support are required before DMHIs can be truly implemented in care settings. Future studies should explore hybrid models of care in clinical practice. It seems undeniable that the future of psychological healthcare will include digital solutions, and if done properly, they will contribute to increasing society’s well-being.

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