Chapter 1
Mobile Mental Health: Opportunities and Challenges

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ABSTRACT

Several people with mental health problems do not receive suitable treatment and often avoid or delay seeking help due to concerns about being treated differently and other practical barriers (for example, services costs and unavailability). The mobile health concept has gained more enthusiasts worldwide exactly because it helps mitigate some of these issues. However, despite the emerging scientific evidence in the last decade that proves the efficacy and safety of these interventions, professionals have shown some doubts and worries about their implementation, especially in the mental health field. Thereby, this chapter provides a review on the subject, presenting several mobile applications for mental health problems and also the expectations and needs of health professionals and users for development and implementation of a mobile application.

INTRODUCTION

Mental health problems are a global challenge that affect a large number of people of all ages and from all social status. According to the World Health Organization (WHO), 4.4% of the world population, about 322 million people, suffer from depression and 3.6%, about 264 million people, from anxiety (WHO, 2017).

Due to the costs associated with treatment, many individuals who experience mental health problems do not receive timely professional care. But cost is not the only contributing factor; other reasons include a shortage of specialized professionals, difficult access to services, and the stigma yet associated with mental illness.

At the same time, the use of digital therapies is increasingly spreading and the enthusiasm for combining mobile technologies in support of healthcare has led to the appearance of a new interdisciplinary field called mobile health (mHealth). According to data from the report "The New Decade of Health and Science" (IQVIA Institute, 2021), Covid-19 has been a catalyst for change, promoting remote and

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virtual models of healthcare. Nowadays, more than 10.000 mental health applications are available for download (Carlo et al., 2019). Although applications focused on well-being in general still represent the majority of software of this kind, the number of those focused on managing mental health conditions is increasing.

In this context, smartphones have come to stand out as attractive platforms for mental illness self-management and psychosocial rehabilitation because they are easily accessible, can be carried anywhere by the user and, obviously, have the ability to connect to the Internet. Mobile Health presents several purposes, from prevention to intervention: allows its users to better manage their condition by giving them reminders to take their medication, tracking mood patterns, providing coping and problem-solving strategies, delivering cognitive-behavioral interventions, collecting vital signs by sensors, and so on.

mHealth interventions have several benefits: (1) allows the users to use them 24/7 in a portable and flexible way; (2) might reach people who would otherwise not seek treatment; (3) it is easy and intuitive since most people already use their mobile phones and other applications on a daily basis, and the youngest are already considered digital natives; (4) could be used to deliver large-scale interventions in emerging and low-income economies where resources for mental health are scarce; and (5) individuals can be supported in applying treatment-related skills in real life situations, in which behavior change is at its most vulnerable, and clinicians often struggle to support individuals appropriately (Weisel et al., 2019).

Throughout the technological evolution, different functionalities of mobile phones have been used: calls, text messages, emails and more recently mobile applications. Regarding this last item, recent research on the creation of chatbots or virtual assistants has proliferated. Maybe some users find it easier to share potentially embarrassing information with a "virtual therapist"; when patients talk to a psychotherapy bot, they report not feeling judged. In addition, these systems are always available and can offer a much higher frequency of therapeutic interactions compared to a human therapist.

Despite this great interest in the use of mobile applications in the area of mental health, the level of scientific evidence in most of these mobile applications, is relatively low or non-existent. Some trials showed the potential of apps targeting mental health symptoms, but using smartphone apps as stand-alone psychological interventions cannot be recommended based on the current level of lack of evidence (Weisel et al., 2019). What many authors have suggested, is the complementarity with the preferred therapy, whenever possible. These mental health mobile applications seem to contribute to helping its users to engage in health-promoting behaviors outside the clinical context or in other activities such as therapeutic homework and facilitating the generalization and transfer of skills. Obviously, we should pay attention to the applicability to different populations – for instance, young people and older adults will have different needs which could lead to different apps or different features of the same app.

Given the need for instruments to assess the quality and effectiveness of mobile apps before they become publicly available, the American Psychiatric Association (APA) has developed a 4-step evaluation model for mental health apps whose result can help therapists and users decide whether an app can be used to help with treatment or not (2018). Legal regulations and guidelines on these digital therapies are also beginning to emerge in Europe and in the United States of America, which the authors will present in detail in this chapter.

Nevertheless, the user retention rate for smartphone apps in the general population is low, and reports for mental health apps show limited downloads and poor retention, especially outside of clinical trials and research settings (Bauer et. al, 2020). Continuous interaction leads to higher engagement rates which in turn leads to higher retention, and retention is one of the most important statistics to ensure

your app's success in the long run. Personalized feedback and motivational support are two important structures to improve use adherence.

Considering Alqahtani & Orji (2020) study, users placed more emphasis on the user interface and the user-friendliness of the app. They valued apps that present them with a variety of options, functionalities, and content that they can choose. Users need a way to have tailored recommendations for their mental health and wellbeing needs because they are busy and often struggle to pay or find a real therapist. Another interesting issue, is that users make a choice for a mental health and wellbeing app based not only on ratings, qualifications and reviews, but also on friends, family or professionals.

Among the most common potential challenges are technical problems and factors related to telecommunication, such as system failures, reliability and sustainability of connections, security and data privacy, in addition to the identification of timely crisis management and risk of damage, elements that must be carefully considered when try to integrate smartphone technology with behavioral health care. Other pitfalls include lack of customer service and trust.

To sum up, the use of mHealth services should consider aspects such as the clinical evidence, the improvement of the quality of mental healthcare, the empowerment of the user, the training and education of professionals and users about mobile applications functioning, the sharing of information between systems, the concerns about security and ethics.

Throughout this chapter, the authors intend to address all these themes with depth and reflection, presenting the state of art of mobile mental health. The authors will review mobile applications used in the context of mental health and psychosocial rehabilitation, identifying frameworks and guidelines on how they should be developed in a multidisciplinary perspective, in a process not only centered, but participated by the end user.

TELEHEALTH ON PSYCHOSOCIAL REHABILITATION

Psychosocial rehabilitation, by definition, encompasses different therapeutic approaches that intend to help people with mental health problems, focusing on developing skills and coordinating resources. Psychosocial rehabilitation is revealed by robust and cohesive principles, which are presented below (Marques & Queirós, 2012; Nemec & Chan, 2017):

- Person-centered practice;
- Evidence of adaptations and modifications, both environmental (social and physical) as well as personal, considering those that best suit the person;
- Focus on the person's strengths and capabilities;
- Demonstration of the existence of a feeling of hope for the person;
- Optimization of the person's vocational capacities, in order to promote autonomy and independence, achievement of personal goals, to have a role in society;
- Eradicate the existing stigma in society with regard to mental illness;
- Person involvement in the treatment/ intervention process, always considering their values, experiences, feelings, ideas and goals;
- Existence of a continuous process over time.

Psychosocial rehabilitation facilitates the recovery of people with mental health problems, maintaining and improving their skills and adaptive supports. However, when face-to-face rehabilitation is not feasible, it is necessary to provide remote psychosocial rehabilitation. This approach consists of using synchronous and other asynchronous digital services. It should be noted that telephone calls are viable, however they are not sufficient to be considered a remote psychosocial rehabilitation (Rudnick, 2020).

The global pandemic of Covid-19 emphasized the role of telehealth and digital tools to provide follow-up in times of need. Even before the Covid-19 pandemic, the recognition of the potential of using technology, especially mobile technology, to support mental health was quickly increasing (Ben-Zeev et al. 2020; Buck et al. 2020; Lecomte et al. 2020). Currently, many health professionals and patients are processing the full potential of these digital tools, since face-to-face monitoring has become more difficult or even impossible (Torous, Myrick, Rauseo-Ricupero, & Firth, 2020; Rudnick, 2020).

Digital interventions have the potential to reduce the prevalence of mental illness disorders and improve mental health in populations by integrating preventive interventions to reduce incidence with clinical interventions to reduce existing cases (Taylor et al., 2020). Telehealth has been described as "the next great frontier in the efficient and effective provision of health care" (Varker et al., 2019, p. 621). This intervention is defined as the provision of psychological and mental health services through technologies and telecommunications. These modalities include telephone therapy, videoconferencing, mobile mental health applications and programs provided over the Internet. In addition, digital interventions can be described as synchronous or asynchronous. Synchronous therapeutic monitoring is interactive communication that takes place in real time, both over the phone and by videoconference, and is more similar to face-to-face. Asynchronous treatments, on the other hand, consist of emails, texts, mobile applications and online programs. Many professionals already use these asynchronous monitoring methods to check the patient's progress, provide complementary materials, online assessments and recommend mobile mental health applications or online programs. Research on online mental health monitoring provided to children, youth and adults demonstrates that interventions are feasible, acceptable and as effective as face-to-face services. For example, a recent meta-analysis of synchronous telehealth monitoring reported its effectiveness for adults with common mental disorders. Most studies have found that therapy by telephone or video-conferencing was as effective as standardized face-to-face treatment (Reay, Looi, & Keightley, 2020).

In addition, technology-enabled mental health services, such as those made available via web or through mobile applications, can help expand the reach of clinical care and decrease demand in the mental health system. There is growing evidence for the effectiveness of mental health treatment and support through mobile applications. However, digital mental health services are often not integrated into mental health systems where they have the potential to have a substantial impact (Lattie, Nicholas, Knapp, Skerl, Kaiser, & Mohr, 2020).

As telehealth becomes more commonly used in mental health, it will be important to assess its relative results and effectiveness. Mental health professionals have different sets of skills and research on the effectiveness of telehealth also needs to be directed to the different professions. Consequently, it will be necessary to develop specific professional training and skills to provide this kind of care. Telehealth technology also needs continuous research, due to the cybersecurity challenges that have been observed (Reay, Looi, & Keightley, 2020). Some authors claim digital monitoring should be considered a complement to existing care and, therefore, evidence is needed on how it can integrate with face-to-face mental health as well as other digital services in the mental health area. (Reay, Looi, & Keightley, 2020).

ADVANTAGES OF MHEALTH ON MENTAL HEALTHCARE

The definition of mHealth is wireless communication technologies that transform health, healthcare and public health (Steinhubl, Muse, & Topol, 2013). Mobile applications are being used to assess psychopathology, improve the quality of care, provide interventions, provide access and monitor patients as well as reduce the stigma surrounding mental illness. The general reason for many digital mental health interventions is the large gap in mental health treatment, which includes a lack of therapists, long waiting lines and individual barriers to stigmatization. These digital mental health interventions cover a wide range of interventions, including virtual and augmented reality programs, telehealth, conversational agents and chatbots, serious games, feedback and reinforcement interventions, routine and results monitoring. Internet-based treatments can also be applied as an adjunct to standardized face-to-face treatment to improve treatment or as independent alternatives for treating people with promising results (Schuster, Topooco, Keller, Radvogin, & Laireiter, 2020). Some authors argue that digital therapies should be integrated into treatment with professional supervision rather than as a self-treatment tool (Chivilgina, Elger, & Jotterand, 2021).

Many studies have reported the benefits of mobile mental health applications, such as improving symptoms and reducing recurrence or relapse. However, there are still a number of aspects to improve related to quality of service and data privacy, among other issues. In order to overcome these barriers, better cooperation with medical institutions and evidence validated with greater rigor as to its effectiveness in the treatment of significant clinical symptoms is necessary (Li, Lewis, Chi, Singleton, & Williams, 2020; Tan, Teng, Qiu, Tang, Xiang, & Chen, 2020).

There is evidence that attitudes towards online psychotherapy were positive, despite the tense contextual factors of the Covid-19 pandemic. In addition, it was evident that some factors such as the previous online experience of psychotherapy, the preparations of both the psychotherapist and the patient and the experience itself during the session. Since the experience of digital psychotherapy has shown a good acceptance by all involved, it is possible that after the decrease in initial stress and with the increase of experience by therapists, the video-conference sessions become something more comfortable, natural and something to consider for the implementation of the common therapeutic follow-up (Békés & van Doorn, 2020).

The advantages of using digital therapies consist of reducing the distance between the therapist and the user, providing evidence-based intervention, psychoeducation and easy adaptation to users with mild disorders and the stimulation of self-management skills by the users. In addition to this, there are benefits such as reduced waiting time, flexibility of time, assistance from minorities and the disinhibiting effect of the user being in a familiar environment which can help the therapist to improve the treatment. This way, as expected, it is easier to share and transmit any relevant information with the household.

As previously mentioned, several authors consider that the combination of face-to-face and online treatment in mental health care is an intervention that can offer several advantages, being defined as the combined intervention. In addition to the benefits mentioned above, this intervention has the potential to increase patient involvement and a sense of control over their own treatment, reduce barriers to receiving mental health care, provide more consistent and evidence-based treatment, lower costs and can also be customized to fit patients perfectly.

However, there are studies that evidence a wide range of difficulties with implementing results for mental health interventions, including acceptance by therapists and patients, the therapists' lack of knowledge on how to adjust digital mental health in the best possible way of treatment. At the same

time, there is a sub-ideal adjustment in relation to existing technologies, such as electronic patient records and practical barriers, as well as continuous maintenance of the technology or good access to the internet (Kip, Sieverink, van Gemert-Pijnen, Bouman, & Kelders, 2020). Other disadvantages of any digital intervention are data security problems, risk of discontinuing therapy, difficulties associated with dealing with the crisis and transferring to daily life as well as the use of a lot of technology. In addition to this, it is more impractical to observe non-verbal signs, and the avoidance of a difficult question on the part of the user becomes more feasible. In technologies such as applications, which are mostly not programmed with mental health professionals, there is a shortage of important aspects of the illness. Due to these inconveniences, they can have an impact on the patient's intervention plan. Associated or not with these factors, may be the patient's desire not to participate in these sessions, which ends up becoming another barrier in the implementation of digital therapies.

The lack of successful implementations of technology-enabled mental health services can, in part, be driven by the development of digital mental health tools occurring independently of mental health care providers and the context of the health system and, therefore, these are not well designed for the target population. Without an understanding of the specific needs of healthcare professionals and organizations, and without extensive knowledge.

mHealth can incorporate characteristics often associated with usual health communication methods, such as personalization, tailoring, interactivity, and message repetition at a low cost. Some key features may include voice and video calling, text and multimedia message services, multimedia, several specific sensitive sensors to touch or motion, and device connectivity. Mental health apps are used for many purposes, including: to communicate with other patients, caregivers, or clinicians; to augment psychotherapy and medical support with journaling, symptom tracking tools, and psychoeducation between clinic appointments; to (smart) monitor, that is, to use tools to predict relapse behavior or worsening affective symptoms, through sensors and data activity; to practice self-assessment and care through reflection about their symptoms; and to organize long-term activities, moods, and therapy homework (Hilty, Chan, Hwang, Wong & Bauer, 2017).

Another innovation in the mobile mental health market are the conversational agents, also known as chatbots, which emulate a conversation, sometimes using a simple text interface, others using avatars. Nowadays, speech recognition and natural language processing technologies can provide the chatbot with the capability to identify and express emotions, mimicking a more or less empathic relationship (Luxton, 2020).

Digital health innovations could be used to augment, scaffold, and enhance mental illness management and recovery (Ben-Zeev, et al. 2019). The following table, adapted from Martinez and Farhan, 2019, shows how each individual discipline of data driven applications for mental health respond to the different stages of healthcare: prevention, diagnosis, treatment and monitoring.

DEHUMANIZATION IN HEALTHCARE SERVICES

One aspect that has to be considered when using more and more technology and automatisms in healthcare services is how "human" these services are for the patients. From a patient perspective it is, most of the time, important to feel humanity and empathy as part of the recovery and healing process. In fact, there are multiple studies that suggest that the way patients are treated influence the outcome of their treatments (Vahdat, Hamzehgardeshi, Hessam, & Hamzehgardeshi, (2014).

Table 1. Applications for different stages of mental health healthcare

	Pre-treatment		Treatment	Monitoring
	Prevention	**Diagnosis**		
Analysis of large data sets	x			
Neuroimaging		x		
Chatbots			x	x
mHealth			x	x
Telemedicine			x	x
Clinical decision support systems		x	x	x
Natural language processing	x	x	x	x
Speech recognition	x	x	x	x
Bio sensors	x	x	x	x
Genomics	x	x	x	x
Virtual therapists		x	x	x
Virtual and Augmented Reality		x	x	x
Implantation of medical devices			x	x
Robot assisted therapy			x	x

Source: (Martinez & Farhan, 2014)

The choice of words, attention to non-verbal communication, empathy, active listening and also body language are all important aspects of communication in healthcare services and especially in mental healthcare (Mata et al., 2021). For that reason, healthcare schools and universities around the world are including classes of healthcare professional - patient interaction in their programs in order to teach best practices and close that communicational gap.

Although the use of cutting-edge technology in healthcare has many positive aspects, the intensive use of some forms of technology can lead to the dehumanization of these services, especially if the technology is used to replace critical activities that are typically taken care of by humans. If we simply replace humans by emotionless healthcare technicians, people that simply execute their job based on data and technical knowledge, leaving aside all kinds of human emotions and empathy by the ones they are treating, we would have a cold, mechanical, emotionless world where the patients would be treated almost fully based by their physical issues forgetting the importance of their psychological and mental wellbeing. Let us imagine a scenario where a difficult diagnosis must be communicated to the patient, the way the diagnosis is communicated has a tremendous impact on the patient. Now let us remove from this scenario all human interaction and replace the healthcare professional in charge of giving the news by some other form of digital communication like a text message or an app and we may have a cocktail that leads to even more negative impacts for the patient and for her/his recovery.

Owners and developers of apps and digital services designed for mental health care must be aware of the risks of dehumanization. Although there may be positive outcomes of having patients using completely autonomous mental health tools - like the full availability of these services or the non-judgmental aspect of chatbots - there is also a downside of how these unsupervised services may negatively affect their users by bypassing all human interaction and replacing it by a set of algorithms and blind rules that are applied

to all users without any kind of attention to details and signs that can only be captured by humans. In the absence of a human supervising these interactions, it is nevertheless possible to implement systems that detect patterns that may be an indicator that urgent human intervention is needed for some given cases transforming unsupervised services into semi-unsupervised services with some form of human control. With that in mind, it is possible a balance between procedures that can be automated and taken care of by digital services and human intervention when needed creating a symbiosis of technology and humanity.

INTEGRATION OF DIGITAL TECHNOLOGIES IN MENTAL HEALTH RECOVERY

The interdisciplinarity of two different fields of study like healthcare and technology opens the road for new roles that often make the liaison between both ends and address new challenges that arise from this synergy. The "mental health technology specialist" is a new role proposed by Carpenter-Song, in 2021, that aims to pick the right tools and technologies to apply to a given case in integration and collaboration with the care team. The mental health technology specialist selects the most suitable tools and technologies for each case based on six major principles: accessibility, integration, focus on recovery, focus on the individual, shared decision-making and creativity. From there the intervention begins and it is composed of four different steps: goal setting, researching and evaluating tools, demonstrating and selecting tools, and ongoing support.

In order to follow best practices and standards, the evaluation of the available tools follow the APA framework and in the end a shortlist of apps and services is presented to both clinician and patient based on the needs and goals of each case. A demonstration of these pre-selected tools is given in order to select the most suitable, in a process that again includes the technology specialist, healthcare team and patient. Once the patient starts the use of the chosen technology monitoring and support is given in order to remove any blocker that may appear. A post-intervention analysis is also made in order to fully assess the impact of the selected technology on patients (Carpenter-Song, 2021).

In addition to mobile applications being developed for people with mental health problems, there are some applications designed to simplify the workload of clinicians. Mental health professionals reported a high level of interest towards a mobile app for detection and treatment of mental disorders in the primary healthcare setting (Pokhrel et al. 2021). There is also motivation for practitioners be connected or linked to patients' accounts to facilitate communication and to follow-up their recovery process (Patoz et al., 2021). There are also more informative applications that allow professionals to quickly access specialized information at any time and place (example, PsycEssentials with relevant information on psychotropic drugs, referral resources, and assessment tools).

The ideal model would be an effective integration of the use of mobile applications into the traditional care process by professionals in a unified manner in the flow itself.

APPS AND SERVICES EVALUATION

Given the rapid growth and dissemination of mental health apps, it is very hard for users and healthcare professionals to be up to date with all the new and enhanced applications and services that pop up almost every day. This brings concerns about usability and safety of these apps both for their users and professionals and creates barriers when it comes to recommending apps as part of a treatment. Furthermore,

the general public rely more on app store reviews and rankings than on a professional's opinion when they look for a healthcare app or service. This type of behavior adds risks and raises concerns among the mental health specialists (Lagan et al., 2020).

Although hundreds of applications are available on different marketplaces and app stores aimed for different kinds of conditions, therapies and treatments in the scope of mental health, several reviews demonstrated that the apps with the highest number of downloads focus on the scopes of relaxation, mindfulness and meditation. These are also the apps with the most discordant reviews and feedback from the users (Carlo et al., 2019).

Nevertheless, regulatory efforts have been made. The American Food and Drug Administration (FDA) published in 2015 a series of guidelines and best practices that developers should follow in order to deliver safe to use apps and services. Unfortunately, most of these apps are not categorized as medical devices leaving them outside of FDA's regulatory scope. At the same time there is not a real certification alternative provided by the different app stores and marketplaces. To fill this void, various app rankings have emerged to provide a more informed review and evaluation, however none of the more than forty-five existing evaluation frameworks is suitable to be used in health technology assessment (HTA), meaning that the potential effects of the use of these apps are not well described by all these frameworks. The FDA's Pre-cert initiative - a regulatory model of software development best practices - it is already a topic of debate due to the slowness of the process and the lack of engagement of software developers.

An evaluation framework developed by the American Psychiatric Association (APA) assesses an app based on five major parameters: Access and background; Privacy and safety; App effectiveness and clinical foundation; User engagement and usability; Data integration towards therapeutic alliance and goals. For each evaluation parameter there is a set of questions that should have an objective answer. This method brings clarity and transparency to users and professionals and helps to set expectations about the use of these apps. The framework reflects the best practices designed by different stakeholders including healthcare professionals and developers, however the framework is not specific for mental health applications, but for a broader spectrum of any mobile health app. In the table below (Table 1) there are some examples of evaluations of mobile apps using this framework.

These evaluations are not intended to enable the users or professionals to decide about choosing these specific apps for actual use, but it is strongly encouraged that users, along with their clinicians to conduct their own assessment using this framework as reference.

It is clear that the traditional review platforms do not address the specificity of these types of apps and services and that the reviews of a common user are not a guarantee of anything. An app that may have a direct impact on the health status of a user should not be reviewed in the same way as one is reviewing a game or an inoffensive utility. For that reason, alternative review frameworks have popped up recently with the goal of being a more trustable source of truth regarding the assessment, evaluation and review of mental health mobile apps.

MindApps is one these alternative review platforms that provides a public and transparent approach, promotes the discussion around the available features, quality and usability of these apps providing information for an educated choice both for users and healthcare professionals. More than just a review platform, MindApps (https://mindapps.org/) is an enhancement to the APA framework that translates the different evaluation vectors to a set of objective metrics and stores these metrics into an online database that is publicly accessible, searchable and filterable by hundreds of different parameters. Each mHealth application available in the database is scored objectively either by binary or numeric values in order to describe fundamental features grouped by the following major filters: platform, developer type, cost,

Table 2. Mobile apps evaluation based on APA evaluation model

	Description	Evaluation
MoodPath (MindDoc)	Monitoring and self-management application that provides continuous long-term symptom monitoring for individuals with mental health problems. This enables users to recognize patterns in their symptom trajectories which then can be shared with a mental health care provider or used for self-management. It (1) provides users orientation regarding the need to consult a mental health care provider who can use the monitoring data to prepare an actual diagnosis and support a follow-up therapy; (2) enables users to self-manage symptoms and related problems by providing both transdiagnostic and disorder-specific evidence-based courses and exercises which help them to recognize, understand, and cope with signs and symptoms of mental disorders.	ACCESS & BACKGROUND: the source appears to be reasonably trustworthy; the app works when in airplane mode; Moodpath claims to be "developed and validated in collaboration with scientists." PRIVACY AND SAFETY: it clearly outlines what information is collected and whether it is classified as health-related, technical, or app usage data; It states that health data is anonymously sent to research universities. Users can choose to participate in Health Data processing by giving consent on the app, which they interpret as choosing to use the app. CLINICAL FOUNDATION: the information appears to be well-written and clinically accurate; the website sites that there are studies being done using the app. USABILITY: The app provides free modules for understanding depression, mindfulness and dealing with coronavirus. It also shows several other modules that are restricted until the user subscribes to their quarterly program. These premium modules include: rumination, self-confidence, emotions, and sleep. THERAPEUTIC GOAL: The app suggests new behaviors and ways of thinking about situations. Its modules appear to help users develop insight into anxiety and depressive symptoms. It suggests mindfulness exercises. This could lead to positive behavior change or to skill acquisition. The app is intended to be for individual use, but if user wishes to use app data to supplement care, there is an option for data export.
Woebot	A simulated supportive conversation that encourages authentic disclosure and makes therapy radically accessible. Woebot uses AI and Natural Language Processing techniques to learn from millions of conversations annually and to provide therapeutic encounters that are psychologically related, responsive to a person's dynamic state of health, and targeted using tools from cognitive, behavioral, and interpersonal disciplines.	ACCESS & BACKGROUND: the app did not identify funding sources and conflicts of interest. PRIVACY AND SAFETY: The app uses data to refine their algorithm to improve their product and tailor the user experience. Woebot shares data with Facebook for users. A special Woebot program may share data with medical academic partners or other partners. When using the app, chatbot informs the user of this policy. CLINICAL FOUNDATION: Woebot provides a citation in-app to a research study at a university. USABILITY: The app clearly outlines its use cases and target audience (e.g., those seeking an automated chatbot to assist with depression symptoms). THERAPEUTIC GOAL: Unclear or no information apparent during this evaluation.
WRAP	• Based on the Wellness Recovery Action Plan, the WRAP App walks the user through the process of creating his/her personal WRAP, with a friend or supporter, or in a WRAP group. Whatever the goals or challenges, the user can: (1) discover simple, safe, and effective tools to maintain wellness; (2) develop a daily plan to stay on track with your life goals; (3) identify what throws you off track and develop a plan to keep moving forward; (4) and gain support and stay in control even in a crisis.	ACCESS & BACKGROUND: Advocates for Human Potential (AHP) funds the app but the reviewers were unable to find information about conflicts of interest. PRIVACY AND SAFETY: The reviewers were unable to determine a clear answer to this question given information provided by the developer. CLINICAL FOUNDATION: WRAP is an established, evidence-based treatment with positive benefits; unclear if the app supports the same positive benefits through virtual services. USABIITY: The app is easy to use and includes a Wellness Toolbox and daily plans (for example, customizable Crisis and Post-Crisis plans), with respect to the needs and priorities of the user. THERAPEUTIC GOAL: the user can e-mail WRAP App-collected user information to provider for treatment purposes. Traditional WRAP is associated with positive features and outcomes; unclear to reviewers based on evidence provided as to whether the WRAP app replicates this as-is.
Youper	AI chat-bot app designed to help users identify, track, and process their thoughts and feelings. Utilizing cognitive behavioral therapy, acceptance and commitment therapy, and mindfulness, it may help users improve their mood and sleep patterns, and reduce their symptoms of anxiety, stress, and depression. The app includes 4 main features: Youper the AI Chat-Bot, Journal Logs, Mood Logs, and an Emotional Health Assessment.	ACCESS & BACKGROUND: Claims to be an "emotional health assistant." The team which develops the app counts with psychologists and psychiatrists. PRIVACY AND SAFETY: The website states, "We DON'T collect or store medical information or Protected Health Information..." and data could be deleted. CLINICAL FOUNDATION: Youper is based on evidence-based psychological techniques. However, the developers do not reference the sources due to the conversational nature of app. USABILITY: The app is easy to use and it clearly defines its functional scope as using AI to help to treat stress, anxiety, depression. THERAPEUTIC GOAL: The app can be used in conjunction with a provider and works with HealthKit.

Source: (APA – Sample app evaluations, 2019)

accessibility, privacy, clinical foundations, features, supported conditions, engagement strategies, inputs, outputs and use types. MindApps also does not provide a ranking, a top or a list of best apps, instead it provides a searchable database that allows any user to find the app most suitable to their needs, however links to the different marketplaces are available with the feedback and scores of users (Lagan et al., 2020).

MOBILE PHONES USAGE IN PEOPLE WITH MENTAL HEALTH PROBLEMS

Covid-19 has changed the field of psychosocial rehabilitation drastically from in-person to virtual or remote services, and there seems to be no question that patient access to clinicians is better than no access. Findings suggested increased use of digital mental health tools and other technologies over time during the early stages of the Covid-19 pandemic (Sorkin et al., 2021).

There is the (wrong) idea regarding the use of smartphones, computers and social media among people with mental health problems and particularly towards people with serious mental illness such as schizophrenia. Approximately three quarters were willing to use a device to access interventions for stress, health and mental health (Brunette et al., 2019). Despite that, smartphone use by those with serious mental illness is generally lower than for the general population (Abu Rahal et al. 2018; Carpenter-Song et al. 2018) and the need to increase digital skills, and the use of multiple consumer technologies should be encouraged and supported (Bauer et al. 2020). Furthermore, some people with mental health problems need skills training to improve digital health literacy and access to health information (Athanasopoulou et al., 2017; Greer, Robotham, Simblett, Curtis, Griffiths & Wykes, 2019).

Obviously, younger people living with schizophrenia use personal technology more than older people with schizophrenia (Simões de Almeida, Sousa, Marques & Queirós, 2018), but in general, all mobile apps and services should be usable, accessible, feasible, effective and follow well known design patterns that deliver a good and predictable user experience. This is no exception in mHealth apps that rely on the user engagement as part of the treatment effectiveness. Multiple best practices and design standards exist to make the use of an app an enjoyable experience and keep the user engaged and interested. On the top of the use of user interface standards and design patterns that deliver a predictable interaction, strategies like gamification are also something to consider as a driver of user engagement. Gamification is a way of transforming a boring or repetitive task into a challenge where physical or virtual prizes are given to the user when a goal is achieved. Some of the most popular mental health apps use this strategy extensively to keep users interested and highly engaged.

The use of mobile devices allows resources like motion sensors or GPS location to be used as an extended source of information that can be used to create better contexts and enhance the set of data that is generated by the user implicitly and explicitly. The best practices and official regulations like the GRDP and CCPA state clearly that the user is the owner of its own data and that every data point collected should be used for the benefit of the user. The user should be informed of what data is collected and with what goal or purpose. The data handling transparency is crucial, especially when the data includes personally identifiable information and health data with a high potential of misuse if poorly collected and stored. Ideally, data management should be a topic of discussion involving the different stakeholders during the design phase of the app and recurring during the different iterations of the product in order to achieve an optimal data handling process with eye on security and privacy.

MHEALTH FROM DESIGN TO IMPLEMENTATION

The private sector is quicker to develop mobile apps, but that brings more risks - this fact does not mean that apps are bad at first, but sometimes they do not have enough evidence to support them (reviews and download pages are not enough to make a thoughtful and correct choice). The use of eHealth services should consider aspects such as efficiency and improving the quality of healthcare, empowering the user, encouraging the creation of a new therapeutic relationship, educating professionals and users about the functioning of the applications, the sharing of information between health facilities, the expansion of care provision, interventions supported by evidence, ethics and equity, and technologies should be accessible to all users regardless of their skills and socioeconomic status (Beentjes, Gaal, Goossens, & Schoonhoven, 2016). Furthermore, the effective management of psychiatric illness requires collaboration between the patient and the professional, so that problems can be identified, goals set, incorporating the most effective self-management strategies and monitoring the patient's progress (Aschbrenner et al., 2016).

It is important to reflect on how these tools are built. There are numerous theories that address the issue of how to design good tools and one of the most used and most suitable methods for designing health technologies is Human Centered Design (HCD). The main idea of HCD is that the lives of the people for whom the product is being designed is fundamental in the project and this must correspond to their needs and their particular context. The design process should focus on finding a solution to a real-life problem experienced by real people, i.e., considering a holistic approach to health: technology, people and context should be involved from the start. This means that each design process starts with figuring out what problem the person is facing and wants to overcome (making sure there is currently no application that responds to that – it is better rather than spending time and money "reinventing the wheel"). The identification of the problem can be done through information obtained from interested parties (through methods such as interviews, focus groups, surveys), through observation of contexts or through scientific literature. Often the identified problem can be categorized into one or more problems.

Next comes the ideation stage and it is at this stage that ideas are generated that could solve the problem analyzed, creating prototypes to visualize these ideas, and testing them with the people who will be the end users (and also indirect users, such as health professionals, family members/ caregivers, hospital organizations or community services). It is essential to define what requirements can be defined as what the technology should do, what content should present, what kind of data is used and what kind of experience should be provided to the user. Not rarely, the formulation of requirements is often left to engineers and software developers who apply a technology-oriented approach without taking the user's point of view, which is wrong. There are different types of needs that can be formulated before designing an eHealth technology: usability and user experience, functionalities (which modules it should contain and in what way); service needs (at the marketing level, for example), organizational requirements (how technology should be integrated into the organizational structure and service routines).

After that comes the actual design process, which usually starts with low-tech prototypes, which serve to communicate the goal and ideas behind the technology. The most important characteristics of the idea must be present in the prototype so that they can be evaluated by users, specialists or other interested parties. This can be done with a paper and pencil layout or something more complex like creating mockups. It is only at a later stage that digital interfaces are developed and the more concrete possibility of testing the usability of the technological tool emerges.

The last phase is implementation, to find out if the product will actually be used successfully by the people it was designed for. According to the international standard ISO 9241-11 (which covers ergonom-

ics and human-computer interaction), usability is defined as the extent to which a product can be used by specific users to achieve particular goals with effectiveness, efficiency and satisfaction in a context of determined use. Usability is not the same as ease of use, nor is it just about a system that works. It is about whether the target users get and do the things they want to do with the system. In this sense, it is easy to understand the need for these tools to be developed by multidisciplinary teams. Broadly speaking, there are two forms of usability testing: based assessments experts and user-based assessments. The former must have in-depth knowledge of both the technology and the health problem in question, while the latter must belong to the target group for which the tool is intended.

In addition to the tool being person-centered, it should also involve them as a participant in its design. In short, it is important to understand how mHealth interventions should be designed and built. User Centered Design or Human Centered Design, as the name implies, involves considering what the user needs at all stages of the design process, representing a systematic process that is essential to ensure that applications are person-focused (McCurdie et al., 2012). In this process, users must be identified at an early stage and then a thorough investigation of their needs and expectations is conducted in order to understand the intended use of the tool (Schnall et al., 2016). However, the design process of these technologies is currently undergoing a change of perspective, as most researchers discuss the application of a new concept called User Participatory Design (Barcellini, Prost& Cerf, 2015). This concept considers that users can, and should, actively contribute to the design of the system, that is, the tool should not only be designed for the user. Concerns about the risk of loss of privacy and confidentiality should also not be neglected in this conception, being one of the aspects frequently identified by end users. Patients must be meaningfully involved in decisions about how technology can be best used to support decisions about their treatment to finally balance the asymmetries and unequal power relationships between patients and professionals in mental health care.

This reflection is extremely important for designing health technologies, but it is even more important when it comes to people with mental health problems. As an emerging area with a unique set of design constraints and concerns, guidelines are beginning to be established that organize the knowledge gained from existing development projects. Thus, theoretical models provide valuable insights for designing effective and sustainable behavioral health interventions, but applying theory to inform digital technology interventions for people with mental illness has received limited attention (Naslund et al., 2017). The health belief model, the theory of planned behavior, the transtheoretical model, and the social cognitive theory are important and overlapping constructs that can inform digital health interventions for people with mental illness.

It should also be noted that the simplicity of the interface and the ease of navigating a program significantly influence how users perceive the quality of online interventions for mental health. User satisfaction and program credibility directly influence therapeutic engagement and benefit. For an intervention to be effective, a pleasant application must be built, with a good graphic design and an intuitive and satisfactory interface. Simplicity also reduces the likelihood of technical difficulties, which can deter user participation. A simpler interface decreases the capacity needed to engage with the application and increases the likelihood of successful engagement. The language used throughout a mental health intervention, particularly a self-help intervention, can also have a great impact on user engagement, and must be simple, concrete, confident and hopeful, so that users understand what is said and get involved in the interventions. User literacy must be considered and the length of sentences and paragraphs is not only limited by smartphone screen restrictions, but also by users' working memory. Making information meaningful to users can help its consolidation by easing memory demands. Using illustrations, such as

faces to represent emotions, can also improve understanding. Decreasing the amount of information is even more important for users who suffer from symptoms of depression or anxiety, because these conditions can restrict the working memory function. Although simpler information is needed at an early stage, exploring deeper information is important to satisfy some users. Building a resource such as a "learn more" or "help" button in a mental health application can allow users to access more information about certain content or resources. In addition, navigating an application can be critical to maintaining a sense of autonomy and competence, as an application that limits a user's freedom of navigation can be frustrating and its use may not be rewarding. Features like a button that takes the user to the home screen can solve this.

The last phase is assessing efficacy of the mobile app. It is important to implement randomized controlled trials with follow up to measure the impact of these technologies, collecting quantitative and qualitative data. Over the last 10-20 years we have accumulated information about mobile applications in the field of mental health and it is now time to mobilize it.

RECOMMENDATIONS AND FUTURE RESEARCH DIRECTIONS

Bakker et al. (2016) formulated 16 recommendations, with different levels of robustness, regarding the development of mobile applications in mental health. Although it is no longer recent, it is still useful for bringing some clues for the development of mobile applications for mental health.

Alqahtani, Al Khalifah, Oyebode, & Orji (2019) also presented some behavior change strategies and recommendations for mental health apps development, such as self-monitoring, personalization and reminder schemes. They stressed as well social facilitation strategies and employing reduction and tunneling to simplify mental health apps and guide users through the step-by-step process required to achieve the desired mental health outcome.

Moreover, researchers, developers and clinicians should consider the needs of the different user profiles accessing mental health services, such as children and young people or older people.

Despite the constant boiling of this topic over the past two decades, the trend to research this topic is here to stay. First of all, there is a need of increased formal training in technology-enhanced care (Schueller et al., 2021). Not only novel professionals should have specific training in the area of digital health in their curriculum, but also professionals who have graduated ages before should update themselves in this field of knowledge.

Regarding the technologies themselves, they need to be constantly improved and evaluated. A recent review of mental health apps users shows that, whilst 64% of apps available in commercial app stores claim to diagnose, manage or help ease the symptoms of mental health problems, only 44% of them use scientific language to assure these claims (Larsen et a., 2019). Nevertheless, keep in mind that proliferation of new mental health apps is often unnecessary, sometimes counterproductive, and often redundant with apps that already exist.

Another important question to be raised is how to increase the (digital) therapeutic alliance? Some authors argued the need to seek clarity on this topic (Henson, Wisniewski, Hollis, Keshavan, & Torous, 2019).

Once again, it is necessary to continue to invest in apps certification methodologies, data security and privacy, personalization and interactivity because these are also major factors that inhibit or lead to a drop out in the use of these technologies.

Table 3. Recommendations for mobile applications development for mental health

Evidence	Recommendation	Details
Effective, but further investigation is needed.	1. Based on Cognitive-Behavioral Therapy	Adopt a conceptual framework to maximize effectiveness
	2. Aims to intervene in anxiety and depressed mood	Increases accessibility and addresses comorbidity between anxiety and depression
Probably effective, but further investigation is needed.	3. Designed for non-clinical populations	Avoiding diagnostic labels reduces stigma, increases accessibility and allows use for prevention
	4. Automatic customization	Personalized interventions are more effective than rigid
	5. Recording thoughts, feelings or behaviors	Self-monitoring and self-reflection to promote psychological growth and allow assessment of progress
	6. Recommendation of activities	Behavioral activation to increase self-efficacy and coping strategies repertoire
	7. Mental health information	Development of mental health literacy
	8. Real-time engagement	Allows users to use the app when they need it most
Supported by theory, but needs further investigation	9. Activities explicitly linked to mood problems	Improves understanding of the cause-effect relationship between actions and emotions
	10. Encourage activities without the use of technologies	Helps you avoid potential problems carefully by limiting time spent on technologies
	11. Gamification and intrinsic motivation to get involved	Encourages the use of the app through rewards, positive reinforcement and behavioral conditioning
	12. Previous app usage record	Encourages the use of the application through personal investment
	13. Reminders for use	Notifications for Involvement
	14. Simple and intuitive interface and interactions	Reduce user confusion and detachment
	15. Links to crisis support services	Help users who are in crisis to seek help
Required for validation of principles	16. Experimental trials to establish efficacy	It is important to establish the effectiveness of the application before recommending it as an effective intervention

Source: (Bakker et al., 2016)

CONCLUSION

Mobile mental health is an exciting and dynamic field that combines skills of two different sciences: healthcare and computer science in order to provide tools that help patients and professionals to manage and to cope with different conditions and that open the way to different approaches and treatments of several conditions. It also means the opportunity to reach more people that in different circumstances had little or no chance to have access to basic mental healthcare due the ubiquity of mobile devices, and the low cost of access to these apps and services.

However, there are also risks to consider. Apps with no technical validation or that run unsupervised can lead to disastrous consequences, especially if the users are not being followed or advised by professionals. There is also the risk of picking the wrong tool or having a tool that is giving the wrong direction and advice to their users. For that reason, there is the need to provide standards and best prac-

tices for both design, implementation, use and monitoring of these apps and services, something that has come to happen with the help of international institutions that aim to regulate this new field and market. There is also the need for different frameworks of evaluation and review of these apps, as the traditional marketplaces and play stores do not provide the necessary information for an educated choice nor the transparency for what kind of features each app offers and what kind of treatments and goals are provided, making hard for professionals and users to rely on the mainstream review frameworks to make the right choice for their needs.

Mobile Mental Health, as the union of two very different science fields, opens the space for new roles and professions that make the liaison between the two worlds. Having someone that understands what are the needs of a patient in terms of mental healthcare and the knowledge of what tools exists, especially mobile mental health apps and services, is a crucial resource to help professionals and patients making the right choices in terms of technology and help them to use these tools the right way in order to maximize the potential benefits.

Replacing a human resource by a mobile application has several positive and negative impacts. If on one side some users may feel more comfortable by sharing their thoughts and feelings to a non-judgmental application instead of having a in person conversation with a professional, there is also the risk of dehumanizing the healthcare services by removing almost completely all the human interactions - which goes against other efforts of keep healthcare as human as possible increasing the human interaction between professionals and patients as one important vector of intervention.

However, the field of mobile mental health looks promising, the advantages of the use of technology in the mental healthcare field are clear and enormous. In the long-term, these tools, apps and services will deliver personalized care designed for a specific user and its specific needs. Also, the correct collection, analysis and application of data will for sure open the doors for new knowledge, new treatments and new approaches that ultimately will benefit professionals and users.

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KEY TERMS AND DEFINITIONS

Chatbot: A program designed to simulate conversations with human users.

eHealth: Use of digital technologies to facilitate health improvement and health care services.

mHealth: General term for the use of mobile phones and other wireless devices for healthcare purposes.

Recovery: Process not focused on symptom reduction but on a personal path of rediscovering a new feeling of identity, self-determination, and personal empowerment to live, participate and contribute to the community.

User-Centred Design: Iterative design process in which developers and researchers focus on the users and their needs in each phase of the process.