Review Article

The Implication of Digital Technologies and Interventions for Mental Health Care

Chommakorn Thanetnit, M.D.*

Abstract

The prevalence of mental health problems during the COVID-19 pandemic was higher than before. Physical distancing policies caused more difficulties in receiving traditional face-to-face mental health care, resulting in wider mental health treatment gaps. Regarding these barriers and the limitation of human resources, digital transformation in psychiatry has been widespread. This article summarized the recent supporting evidence of digital technologies and interventions in psychiatry, including telepsychiatry, computer-based and internet-based cognitive behavioral therapy, smartphone application-based intervention and virtual reality-based therapy, with the most studies for depressive disorders and anxiety disorders. The author also reviewed the usage of mental health chatbots, artificial intelligence, and machine learning. In conclusion, these innovations might be new possibilities in addition to standard psychiatric evaluation and treatment in the upcoming future. However, privacy and security issues remain concerned, which require further studies.

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Department of Psychiatry, Faculty of Medicine, Thammasat University, Pathum Thani, Thailand
* **Corresponding author:** Chommakorn Thanetnit, M.D., Department of Psychiatry, Faculty of Medicine, Thammasat University, Pathum Thani, Thailand, Tel +66 2926 9205
Email: chomtha@tu.ac.th

Introduction

Accumulating evidence suggests the COVID-19 pandemic has negative effects on public mental health.[1,2] Physical distancing, quarantine, and restrictions on social contacts can have a negative psychological impact,[2] including an increase in depression, anxiety and post-traumatic stress symptoms[3] as well as substance abuse.[4] The pooled prevalence of mental health issues during the COVID-19 pandemic was higher than previous reports before the COVID-19 outbreak. The global prevalence estimate was 28.0% for depression; 26.9% for anxiety; 24.1% for post-traumatic stress symptoms; 36.5% for stress; 50.0% for psychological distress; and 27.6% for sleep problems.[5] However, human resources available for mental health care in most low-income and middle-income countries are very limited,[6] in comparison to the increasing demand from overburdened mental health care system. There are even estimates that 45% of the world has less than 1 psychiatrist to every 100,000 people, while over 50% of the world population owns a smartphone.[7] According to the WHO, universal health coverage cannot be achieved without the support of eHealth since digitalization allows the delivery of scalable solutions to many people, even in remote locations.[8]

Apart from COVID-19 and its impact on traditional face-to-face interventions, this review also focused on available digital technologies and interventions in psychiatry, including internet-based computer-aided mental health tools and services, mental health apps and machine learning algorithms,[9] which were considered as important tools for assisting psychiatrist to works in all levels of mental health care, including for prevention, screening, diagnosis and treatment, which improved public mental health without face-to-face contact.

In this review, literature search was conducted using PubMed and Google Scholar without any date restriction. Search terms relevant to psychiatry, mental health, digital technology, and digital transformation were included. Articles written in languages other than English and Thai were excluded. The author considered specific types of the article, such as clinical trials, systematic reviews, meta-analyses in systematic review, review articles, and book chapters.

Telepsychiatry

Telepsychiatry refers to real-time video and/or audio connection between mental health clinicians and patients, including services by telephone. Before the increasing usage of telepsychiatry during COVID-19 pandemic, psychiatry has gone through several waves of technology adoption. One of the earliest and most famous uses of hospital-based telemedicine was in the late 1950s and early 1960s when a closed-circuit television link was established between the Nebraska Psychiatric Institute and Norfolk State Hospital for psychiatric consultations.[10] Several studies showed that clinical effectiveness, treatment adherence, and patient satisfaction were comparable between telepsychiatry and face-to-face therapy.[11,12] There is clear evidence for the effectiveness of telepsychiatry in treating various psychiatric conditions, with the strongest data in depressive disorder,[12] using cognitive and behavioral therapy, as well as for enhancing medication adherence.[13] Thus, telepsychiatry may reduce logistical barriers, no-show rates, appointments' waiting time and decrease travel time and cost,[11,14] which can result in reducing stigma-related barriers to treatments, increasing the patients' privacy due to the less visit and improving access to a care.

While most outcomes were positive, telepsychiatry might not be acceptable and feasible to all patients,[15] especially vulnerable people or people who is unable to access to the internet. Inadequate supports for them may cause the digital gap in society. For equity in psychiatric care, in-person examination still should be maintained for patients who are at risk. Some clinicians and patients reported disliking the difficulties expressing empathy or reading non-verbal communication during conversation. Clinicians also reported problems reading patients' emotions or feeling less connected to the service user compared with face-to-face sessions. Other challenges included a lack of client engagement, possible misunderstandings due to lack of non-verbal signals, or not having a clear idea of patients' physical state.[15] Technical difficulties, such as transmission unable to start, spontaneous disconnections, poor audio/visual quality, and audio/visual delay, also affect the telepsychiatry session, which may result in difficulty detecting non-verbal cues and establishing of therapeutic relationship.

Computer-Delivered and Internet-Based Cognitive Behavioral Therapy

CBT delivered via computer (C-CBT) and CBT provided via the internet on a computer or mobile device (I-CBT) shows the potential of digitalization in psychiatry by treating depressive disorders, bipolar disorders, generalized anxiety disorders, panic disorders, social anxiety disorders, phobias, obsessive-compulsive disorders (OCD), post-traumatic stress disorders (PTSD), and adjustment disorders.[16] There is moderate to strong evidence for the acceptability and effectiveness of C-CBT and I-CBT on measures of depression and anxiety. Especially for depression, there was a large number of systematic reviews and meta-analyses, which mostly resulted in reduction of depressive symptoms.[17-19]

According to a Systematic Review and Meta-analysis of 39 studies comprising 9,751 participants by Karyotaki et al,[20] both guided and unguided I-CBT were associated with more effectiveness as measured by PHQ-9 scores than control treatments over the short term and the long term. Although unguided I-CBT is more scalable and affordable, but many studies have shown that guidance with a modest amount of support from a clinician or other helping person generally results in better outcomes. Anyway, this difference diminished over the long term. Differences between unguided and guided I-CBT in people with baseline symptoms of subthreshold depression (PHQ-9 scores 5-9) were small, while guided I-CBT was associated with overall better outcomes in patients with baseline PHQ-9 greater than 9. The average study dropout rate was 25% for guided I-CBT, 29% for unguided I-CBT, 19% for waiting list, and 22% for treatment as usual. In addition, I-CBT also has the probability of being cost-effective compared with no treatment or to conventional CBT.[16]

Similar to I-CBT, C-CBT with a modest amount of support from a clinician or other helping person was also found to be efficacious with relatively large mean effect sizes on measures of depressive symptoms, whereas self-guided CCBT for depression was considerably less effective.

Smartphone Application-Based Interventions

In context of smartphone health application, there is now developing evidence that included metaanalyses demonstrating reductions in symptoms of depression, anxiety, and suicidal ideation through providing emergency contact details and support from family and friends, risk screening, developing coping skills and emotional regulation strategies, facilitating access to psychotherapy, or developing safety plans. They could be beneficial for individuals at risk of suicide, especially as an adjunctive to therapy for those with decreased help-seeking behaviors.[21-23] However, their safety and efficacy remain inconclusive. In terms of substance use disorder, the evidence was limited except "reSET-O", the 84-day Prescription Digital Therapeutic (PDT) for opioid use disorder, which was authorized by FDA in December 2018. Their retrospective study revealed a net reduction in medical costs, by a reduction in inpatient stays, emergency visits, substance tests, and through the substitution of face-to-face counseling.[24] For insomnia, another PDT was supported by two RCTs resulting in the effectiveness of an online CBT for insomnia program,[25,26] and approved by FDA. The results showed that there was significantly improvement in insomnia severity index, sleep-onset latency, and wake after sleep onset. Treatment effects were maintained at the 1-year follow-up. By using a fully automatized system, this program was also practical and effective in reducing depressive symptoms.

Virtual Reality-based Treatment

Virtual reality (VR) is defined as a computer-generated simulation, such as a set of interactive images and sounds that represents a seemingly real place and situation, or physical way by a person using special electronic equipment. It can transmit various sensations to users to make them feel as if they are in a virtual or imagined environment.[27] This sense of presence experienced in VR, which is ideal for exposure therapy, provides the opportunity to immerse the patients in their tailor-made feared environment. Thus, most studies on VR-based interventions focused on implementation as exposure therapy for anxiety disorders,[28] particularly specific phobia and social anxiety disorder, which was effective compared with waiting-list or placebo conditions.[28-30]

However, exposure to VR applications may result in significant discomfort with symptoms of motion sickness, eye fatigue, headaches, nausea, and sweating in the majority of people.[30] Furthermore, only small effects and little evidence for superior

efficacy were found when comparing VR treatment with conventional treatments, indicating that treatment results were similar but not exceeding those of conventional therapies. The quality of evidence was overall low to moderate, due to the predominance of studies with small sample size.[31]

Artificial Intelligence and Machine Learning

Artificial intelligence (AI) can be defined as the simulation of human intelligence in machines, which are programmed to mimic human cognitive functions such as learning and problem-solving. Machine learning (ML), which is a subset of AI, included algorithms for various kinds of task and algorithms of data.[32] AI-assisted activities included clinical training, treatment, psychological assessment, and clinical decision making.[33] To date, there is the new emerging interdisciplinary field of precision medicine, pharmacogenomics, and psychiatry using computation-enabled platform with integration of knowledge from biomedical research and clinical practice, such as genetic biomarkers and imaging, for individualization of clinical care for patients with psychiatric disorders, which may contribute to the prognosis and treatment response.[34] There also has been a growing interest for ML use in identify predictors of therapeutic outcomes in depression and early detection in individuals with clinical high-risk state for psychosis.[35-37] This also has the potential to improve the assessment of suicidal risk by identifying risk factors and complex patterns of interacting risk factors,[38,39] and by detecting the suicidal thought shared through social media platform.[40] Currently, the available evidence remains insufficient to support its usage to guide the standard management in psychiatry.

Chatbots

Chatbots or conversational agents are defined as digital tools existing either as hardware or software that use AI and ML methods to mimic humanlike behaviors and provide a task-oriented framework with evolving dialogue able to participate in conversation. They converse and interact with human users using spoken, written, and visual languages.[41] Weak evidence demonstrated that chatbots were effective in improving depression, distress, stress, and acrophobia.[42,43] This may be useful to facilitate interaction with individuals who are uncomfortable disclosing their feelings to a human being or reluctant to seek mental health advice due to stigmatization.

Also, the study regarding embodied conversational agent (ECA), a virtual character resembling human being, revealed that ECA can also conduct the standardized and well-accepted clinical interviews for identifying major depressive disorder.[44] Although they are perceived as useful and easy to use, some conversations may be perceived as shallow, confusing, or too short.

Digital Psychiatry in Thailand

In Thailand, digital psychiatry has also become facilitating technology in mental health care system, such as telepsychiatry,[45] teleconsultation in remoted area requiring psychiatric service, and teleconference services for prisoners with psychiatric problems. In terms of mental health application, "Ooca",[46] the first application launched in 2017, has connected 63,000 users with local psychiatrists via video calls to provide counseling service. Moreover, Khon Kaen Rajanagarindra Psychiatric Hospital also launched "Sabaijai" mobile application for basic counseling and suicidal risk screening in individuals in 2017 on behalf of Department of Mental Health.

During COVID-19 pandemics, "Jubjai Chatbot",[47] an automated interactive robot, has also been developed by the researchers of The Faculty of Engineering, Mahidol University and Siriraj Hospital. This chatbot is able to screen mental health status based on the standard questionnaires and chat with users to reduce stress and depression.

Ethical Consideration

The primary concerns of digital technologies in mental health are safety, privacy and data protection, accessibility and consent. According to the guideline launched by The Royal College of Psychiatrists of Thailand,[48] a clinician must satisfy her/himself that they can undertake an adequate assessment, establish dialogue with the patient and obtain the patient's consent, including consent to the remote consultation process. Clinical teams should seek to discuss with patients and caregivers in advance about suitability and willingness to engage via technology. The limitation of the assessment or review must be informed, as this method is unable to replace the usual routine care. Patients

with high risk/unstable/emergency condition should be excluded and transferred to usual care.

In addition, confidentiality and protection of personal health information should be concerned, as mental health data are usually viewed as sensitive and stigmatizing. Clinical teams and patients should both verify themselves they are the right person and manage the environment as private as possible. Back-up plan for managing any technical difficulties (e.g. loss of connection, ransomware attacks) should be done and informed in order to ensure about the security of the platform. Furthermore, clinicians should ask the patients about recording the session with the use of this recording and ideally agree what might be useful for them to be able to take away and that it will only be for private use. Lastly, medical note including date, time, details of consultation, medical order, and fees must be recorded.

Discussion

In terms of the Thai mental health system, adopting digital technologies and interventions might be challenging. Nowadays, a number of digital technologies and interventions were rapidly developed and launched, but most psychiatrists prefer to work in the Bangkok metropolitan area, and the shortage of psychiatrist is still a common problem, especially, in underserved area.[45] Furthermore, an overall lack of theoretical and/or practical training on new digital tools and digital health interventions in psychiatry was observed in the Asia-Pacific region. Despite the limited training opportunities, most of mental health workers declared the necessity to imply digital psychiatry and related disciplines.[49] For these reasons, digital psychiatry may be considered as the potentially useful innovations to match the demand of mental health care. The benefit of digital technologies in mental health care, such as telepsychiatry, video-conference, and chatbot, might include reducing the cost and travel time, reducing psychiatric stigmas, and improving the psychiatric care to be more accessible in the current situation.

However, these technologies should be effectively regulated and comply with the high standards for efficacy, cost-efficiency, safety, and privacy. The quality and efficiency of these technologies with adequate evidence base must be considered before the real world usage in diverse populations and different settings. In order to support and improve these technologies in the mental health care, funding and resource from the policy levels are also needed to equally providing in our country. Further researches regarding these mentioned aspects should be provided before its implementation to bridge the gap between digital technologies in the mental health research and the clinical care in our country in order that patients can benefit from its full potential.

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Conflict of Interest

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