

## AI-based Interventions for Mental Health: Current Scenario and Future Prospects

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### Abstract

Modern artificial intelligence (AI), and machine learning in particular, is being used to create prediction, diagnostic, and treatment solutions for mental health care in light of the growing popularity of digital approaches to mental health. Due to their prevalence, depression and anxiety represent the two main mental health conditions that have been the subject of most digital phenotyping research.

Chatbots have been used for mental health issues since the 1990s, but their effectiveness remains unknown due to their early stages, though some early studies suggest improvement in anxiety and depression. ChatGPT and other AI platforms have potential applications in various industries, including mental health, and are rapidly expanding.

Artificial Intelligence (AI) has the potential to improve accessibility and reduce costs for mental health services by utilizing smartphones. With the increasing use of smartphones, AI systems can be used to diagnose mental illnesses, identify them at a prodromal stage, personalize medicines, and empower individuals in their care. However, AI must address challenges such as bias, privacy, transparency, and ethical concerns. These goals reflect human wisdom and the stronger connection between individual and community well-being than IQ. In the future, AI may develop technology that enables more empathetic and morally upstanding care for various groups, reflecting the importance of human wisdom in addressing mental health issues.

More work is required to bridge the gap between clinical treatment and AI in mental health research, while caution must be exercised to avoid overinterpreting early findings.

**Keywords:** Artificial Intelligence; Chatbots; ChatGPT; Mental Health; mHealth.

### Introduction

The study and creation of intelligent devices fall under the umbrella of artificial intelligence (AI). We are now able to solve issues and carry out tasks in ways that are more dependable, efficient, and successful than they would be without the use of AI technology and methodologies. Although the use of AI technology in medicine has grown relatively popular for

applications relating to physical health, its usage in the field of mental health is significantly more constrained.<sup>1</sup> Soft skills such as building rapport, relationship-building, and watching patients' emotions and behavior are essential for mental health.<sup>2</sup> Like patient remarks and written notes, clinical data on mental health is more qualitative and vulnerable to interpretation. Artificial intelligence has the potential to significantly alter how we identify and interpret mental illnesses. The mental well-being of an individual is shaped by their bio-psycho-social profile, yet our comprehension of the dynamics among these biological, psychological, and social systems remains insufficient. The etiology of mental illness is diverse, and discovering biomarkers will allow us to define various illnesses more precisely and objectively. The potential exists for artificial intelligence technology to create more advanced pre-diagnostic screening tools and risk models, aiding in the evaluation of an individual's inclination or likelihood of developing mental illness.<sup>3</sup>

Additionally, the domains of behavioral and mental healthcare are gaining from advances in AI. Healthcare practitioners can benefit from computational approaches for learning, understanding, and reasoning, for instance, in clinical decision-making, testing, diagnostics, and care management. Self-care tools can be improved by AI technologies and approaches, such as interactive mobile health apps that recognize user behaviors and preferences. By assisting in the identification

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of health concerns and informing interventions, AI is enhancing public health. Another illustration is the employment of artificially intelligent virtual people who may converse with patients and suggest treatments. AI-based mental health therapies have received a lot of interest and have the potential to enhance conventional forms of therapy and support. These solutions use machine learning and artificial intelligence to deliver scalable, adaptable, and individualized mental health care.

AI technologies offer a great deal of potential to help clinical mental therapy in a variety of ways. Firstly, by anticipating treatment responses, AI has the capability to replace time-intensive psychotherapies, invasive and costly brain stimulation therapies, and inefficient pharmacological trials.<sup>4</sup> Studies have used electroencephalogram signals and clinical questionnaire items to predict response to antidepressant medications<sup>5</sup>, electroencephalogram signals to predict response to antipsychotics<sup>6</sup>, gauge electroconvulsive therapy (ECT) response through brain structure analysis<sup>7</sup>, forecast response to cognitive behavioral treatment for anxiety using brain functional MRI<sup>8</sup>, and predict reaction to brain stimulation through MRI analysis.<sup>9</sup> Even while not all of these trials are successful<sup>10,11</sup>, they can help identify the populations that should receive particular therapies.<sup>12</sup> Secondly, AI approaches aid in predicting severe therapeutic side effects.<sup>13</sup> Thirdly, AI methods can help in the development of fresh theoretical models of disease pathogenesis. For instance, bipolar disorder, considered a neuro-progressive ailment, exhibits a growing divergence of neuroimaging abnormalities in affected individuals compared to nonpsychiatric controls.<sup>14</sup>

Similar to this, evaluating the timing and progression of brain alterations throughout the shift from the prodrome of psychosis to schizophrenia<sup>15</sup> will help us understand risk and resilience variables throughout the prodromal phase. By identifying the most significant risk factors for developing illnesses, these methods may also provide new options for early intervention. Fourth, gene expression patterns associated with various psychiatric diseases can be discovered using machine learning (ML) techniques.<sup>16</sup> One study presented a model based on pre-deployment blood transcriptome data that accurately predicted individuals at risk of developing PTSD<sup>17</sup>, stressing immune-related gene dysregulation as a risk factor for PTSD, not merely a symptom.

Finally, AI plays a direct role in advancing novel therapies.<sup>18</sup> Through simulation or data-driven methods, AI can identify promising compounds with therapeutic potential, such as determining the pharmacodynamics of ketamine infusion through blood oxygen level-dependent functional MRI responses.<sup>19</sup>

## MATERIALS AND METHODS

The literature on AI-based interventions for mental health was searched electronically through PubMed, and through the individual study of cross-references and related textbooks; as well as some online resources. Various keywords and their combinations were used for electronic literature searches. In total, around 62 related articles were incorporated in this review article.

## RESULTS

The article enlists various AI-based interventions for mental health such as Chatbots, Sentimental Analysis, Digital Therapeutics, Predictive Analytics, VR Therapy, and Natural Language Processing. Ethical considerations associated with the use of AI in mental healthcare, gaps, and future prospects of the use of AI in mental healthcare research have also been discussed in the article.

### 3.1. VARIOUS AI-BASED INTERVENTIONS FOR MENTAL HEALTH

● Chatbots and virtual assistants: A chatbot refers to a computer software piece utilizing a chat interface, either text or voice-based, to replicate human interaction. The underlying system can range from simple rule-based responses and keyword matching to advanced Natural Language Processing (NLP) algorithms.<sup>20,21</sup> Artificial intelligence-powered chatbots and virtual assistants are designed to mimic human conversation and help those with mental health issues. They can offer psychoeducation, suggest coping strategies, empathically listen, and even identify discomfort cues. Notable examples in the therapeutic mental health chatbot domain include Woebot, Wysa, and Tess.<sup>22,23,24</sup> Woebot, tailored for those with depression and anxiety, delivers cognitive behavioral therapy through brief daily conversations and mood tracking (Fig.1). Wysa utilizes various techniques, including cognitive behavioral therapy, behavioral reinforcement, and mindfulness, to aid individuals facing depression

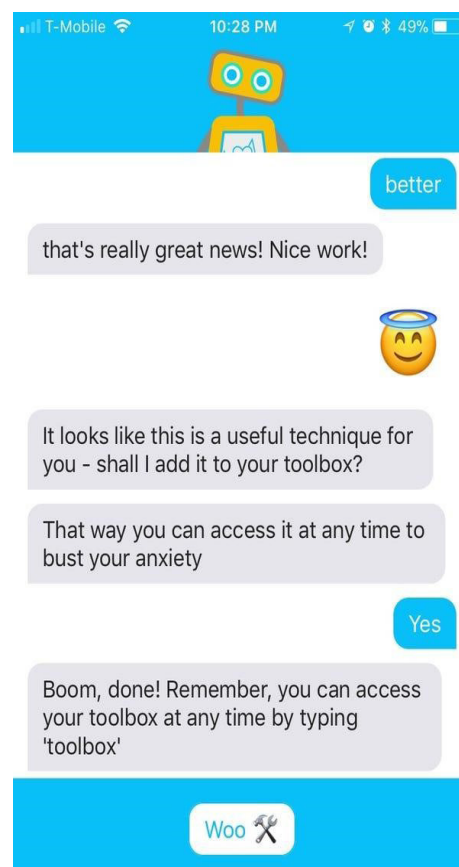


Figure 1: Woebot Health – A popular AI chatbot. (Source: Reprinted with permission from Ref. <sup>25</sup>)

Though there is a possibility that chatbots could improve mental health, further research is necessary to substantiate and validate these findings with larger samples and over more extended periods. Creating emotionally intelligent and empathetic AI for mental health chatbots must consider both the technical complexity of language processing algorithms and the development of emotional and empathic AI.<sup>26,27</sup> The capabilities of AI therapeutic agents extend beyond text-based chatbots with the introduction of virtual therapy agents like ELLIE (Fig. 2), which can not only interpret nonverbal cues but also integrate an avatar representation.<sup>28</sup>



(Source: Reprinted with permission from Ref. <sup>29</sup>)

*Figure 2: ELLIE – An AI-based virtual therapist.*

- **Sentiment Analysis:** In various contexts, the analysis of text sentiment is commonly utilized to discern the mood of the author. Sentiment analysis aims to pinpoint the specific emotion underlying a given situation.<sup>30</sup> Through the analysis of language from online forums, social media posts, and other sources, AI systems may assess the emotional well-being of individuals. By scrutinizing patterns and shifts in language, sentiment analysis becomes a valuable tool in detecting early indicators of mental health concerns, such as melancholy or anxiety. This information can be used to provide support and targeted therapies.
- **Digital Therapeutics:** Software-driven, empirically supported therapy interventions designed to prevent, manage, or treat psychological, behavioral, or physical issues are referred to as "digital therapeutics" as a subset of digital health. The International Medical Device Regulators Forum (IMDRF, 2014) has designated digital treatments as "Software as a Medical Device," and regulatory bodies throughout the world have started to expand their control of these goods.<sup>31</sup> For conditions relating to mental health, these software-based approaches provide evidence-based therapeutic modalities. They usually incorporate cognitive-behavioral techniques, psychoeducation, and mindfulness exercises. Examples include the programs for stress management and guided meditation that the apps Headspace and Calm provide.
- **Predictive Analytics:** To predict and avert mental health crises, AI algorithms may look at a variety of data sources, such

as EHRs (electronic health records), wearable technology, and smartphone apps. By recognizing patterns and risk factors, predictive analytics can facilitate early interventions and tailored treatment plans. The characteristics that influence people to engage in extreme behavior can be analyzed and explored using predictive analytics in the field of mental health.<sup>32</sup>

- **Virtual Reality (VR) Therapy:** Virtual reality (VR) is a computer-generated three-dimensional (3D) simulation that includes sounds and images of actual settings and allows users to interact in a way that seems authentic.<sup>33</sup> VR technology can be used to create immersive and participatory therapeutic settings. One such product has been made by XRHealth which provides Virtual Reality Therapy for Mental Health (Fig. 3). Recreating actual situations that create anxiety or phobias, enables people to address and manage their worries in a secure setting. Originally designed for addressing phobias, virtual reality therapy is currently applied in the treatment of diverse mental health issues, including PTSD, substance use disorders, eating disorders, and autistic spectrum disorder. Virtual reality serves both assessment and therapeutic functions. Researchers can generate scenarios in virtual reality (VR) to assess real-time behavioral, emotional, cognitive, and physiological responses to a virtual environment.<sup>33</sup>



(Source: Reprinted with permission from Ref. <sup>34</sup>)

*Figure 3: XRHealth, providing Virtual Reality Therapy for Mental Health.*

- **Natural Language Processing (NLP):** NLP techniques (Fig. 4), such as speech recognition, sentiment analysis, lexical analysis, semantic analysis, and optical character recognition, play a crucial role in converting unstructured text into structured formats for future analysis.<sup>35</sup> In the field of psychiatry, where language and speech are fundamental for diagnosing and treating mental illnesses, NLP approaches are particularly relevant. Unstructured records from mental examinations are easily accessible, cost-effective, and rich in information that can be leveraged to identify phenotypes and comorbidities.<sup>36,37</sup> NLP techniques make it possible to analyze spoken or written language and generate usable data. In the realm of mental health, NLP can be used to analyze the transcripts of therapy sessions, diary entries, or online support group discussions in order to identify recurring themes, monitor progress, and offer individualized feedback. Examples related to mental health include the use of NLP in the Clinical Record Interactive Search platform<sup>38</sup>, estimating the risk of suicide<sup>39</sup>, and predicting early psychiatric readmission<sup>40</sup> using the EHR's hospital discharge notes. NLP can also have broader applications with EHR or



insurance claims data, automating chart reviews, categorizing patients into specific phenotypes, and forecasting patient-specific outcomes.<sup>41,42</sup>

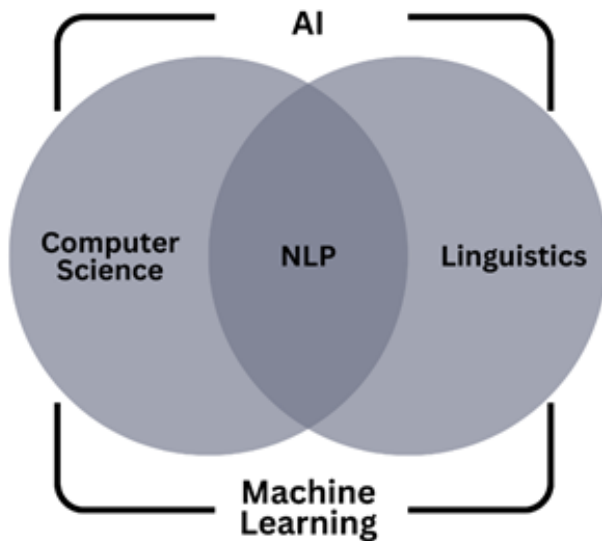


Figure 4: Natural Language Processing (NLP).<sup>43</sup>

### 3.2.ROLE OF SMARTPHONES IN AI & MENTAL HEALTHCARE

For our purposes, wearable and hand-held electronic devices (such as cell phones and tablets) are both referred to as mHealth (mobile health) devices. mHealth software applications, also known as apps, are computer programs that run on mobile devices to achieve a certain goal. According to the Global Mobile Health Market Report 2010-2015, 500 million smartphone users globally are reportedly utilizing healthcare-related apps, including patients, consumers, and healthcare professionals.<sup>44</sup> More than 3.4 billion smartphone and tablet users worldwide are anticipated to have downloaded mHealth apps by the year 2018. Additionally, there are more and more smartphone apps available for specific behavioral and mental health requirements. Applications exist, for instance, to manage health-related behaviors such as adherence to medication, diet, exercise, and sleep as well as to stop smoking. Additionally, certain apps offer immediate support for managing mental health conditions like depression, anxiety disorders, eating disorders, and suicide prevention.<sup>45,46</sup>

A simulated face-to-face encounter is used to conduct conversations between animated computer figures known as virtual humans. They have been widely used as virtual coaches, therapists and counselors to speak with patients directly and provide behavior modification interventions and automated health education, but they have also been used as "standardized patients" to train medical professionals.<sup>47,48</sup> Smartphones and other mobile devices offer special opportunities for using virtual humans in healthcare interventions. First, whenever and whenever consumers need it, the virtual human is there to offer counsel and inspiration. Second, virtual humans are capable of being proactive in providing support and guidance when paired with real-time sensors capable of recognizing user behavior. Lastly, the physical proximity to patients, extended interaction time, and the perception of sharing personal experiences can influence the virtual human's ability to establish a trusting,

cooperative relationship with the patient.

Despite recent advancements in mobile health (mHealth) technology and interventions, there are still systems utilizing virtual human interfaces. The initial DESIA system, developed by Johnson, LaBore, and Chiu<sup>49</sup>, featured animated conversational agents using balloon text and optional recorded speech output for agent utterances. DESIA served as a mobile computer-based psychosocial intervention.



(Source: Reprinted with permission from Ref. <sup>50</sup>)

Figure 5: DESIA, a psychosocial AI-based intervention on a handheld computer.

Smartphones, which provide a variety of skills and opportunities for intervention and assistance, are crucial in the integration of AI into mental healthcare. Here are some significant contributions made by cell phones to the nexus between AI and mental healthcare:

- **Data Collection:** Smartphones have the capacity to gather a range of data types that are important to mental health. They gather user input through apps and surveys, as well as sensor data such as user movement, location, and sleep patterns. AI algorithms can make use of this data to learn about people's behavioral habits and mental health.
- **Access to Resources and Information:** Instant access to a multitude of resources, knowledge, and support networks for mental health is made possible by smartphones. Digital platforms and apps with AI-powered capabilities put psychoeducation, coping mechanisms, guided interventions, and self-help resources at users' fingertips.
- **Real-time Monitoring and Feedback:** Smartphones may track mental health indicators in real-time and deliver fast feedback thanks to AI. To track physiological signals like heart rate variability or identify changes in speech patterns to infer mood states, for instance, wearable devices and smartphone apps can be used. These data can be analyzed by AI systems, which can then offer consumers or their healthcare professionals customized comments or notifications.

- Digital Therapeutics and Intervention: A platform for providing AI-driven digital therapies is smartphones. Cognitive-behavioral therapy (CBT), mindfulness practices, and stress management techniques can all be found in mobile apps. These interventions are adaptable, always available, and can be specifically adapted to a person's needs.

- Behavioral Monitoring and Early Intervention: Smartphones with AI algorithms can passively track and examine communication and behavioral patterns to spot early indications of mental health problems. AI can assist notify people or their healthcare practitioners of potential risks by recognizing changes in speech patterns, social media posts, or smartphone usage patterns, enabling early intervention.

- Teletherapy and Remote Support: Smartphone teletherapy and video conferencing technologies enable remote mental health support. Virtual assistants and chatbots powered by AI may replicate human-like discussions and provide rapid support and direction to people in need. Additionally, cell phones make it possible for clients and their mental health professionals to exchange data securely.

- Ecological Momentary Assessment (EMA): With the help of applications or surveys, people can use smartphones to conduct ecological momentary assessments, reporting their thoughts, feelings, and actions in real-time. This information offers a more thorough picture of people's mental conditions and can be utilized to guide individualized interventions and treatment strategies. It's crucial to remember that while cell phones have a lot of potential, they also come with issues including the need for proper regulatory control, privacy concerns, and data security. It is crucial to maintain a balance between the benefits of AI-powered mental health interventions and privacy and ethical concerns in order to ensure the acceptable and effective usage of smartphones in this scenario.

### 3.3. APPLICATION OF AI IN WEARABLE DEVICES

Researchers are actively developing various wearables, recognizing the significance of maintaining excellent mental health on par with physical well-being. These wearables typically utilize data from parameters like heartbeat, blood pressure, body temperature, or ECG to assess human physiology. Stress evaluation is a common application for wearables, with Choi et al. monitoring children's heart rate and audio signals using wearable technology, employing a support vector machine (SVM) to identify stress patterns.<sup>51</sup> Another approach for stress detection involves using electrodermal activity (EDA), as demonstrated in the emotion board experiment, where skin conductance signals were processed through LDA and SVM classification.<sup>52</sup>

Wearable technology proves valuable in detecting and monitoring psychiatric conditions such as depression. Valenza et al. utilized the PHYCE system to gather data for assessing the depressed status in bipolar disorder.<sup>53</sup> PHYCE, a wearable system prototype, incorporates textile electrodes for ECG and piezoresistive sensors for recording breathing signals. To enhance the accuracy of depression recognition, Roh et al. developed a system-on-chip (SoC) for speeding up the filtering and feature extraction of heart-rate variability (HRV) from an ECG.<sup>54</sup> Their efforts resulted in an improved ability to accurately identify depression.

### 3.4. CHATGPT - OPPORTUNITIES AND CHALLENGES IN MENTAL HEALTHCARE

There are several methods to support mental health with ChatGPT. The following are a few such use cases:

- Emotional support: ChatGPT can offer a compassionate and nonjudgmental ear to those who require it. When urgent professional assistance is not available, it can converse with patients, hear their worries, and provide emotional support.

- Information and psychoeducation: ChatGPT can offer details on mental health issues, available treatments, and coping mechanisms. It can provide psychoeducational resources to assist people in better understanding their mental health and establishing self-care habits, such as articles, videos, or interactive modules.

- Screening and assessment: ChatGPT can help in mental health screening by posing pertinent questions and offering feedback in response to user responses. Potential signs can be identified, and they can direct people toward the right expert assistance or resources.

- Self-help and skill development: ChatGPT can provide individualized coaching and treatments for skill development, including stress management, relaxation measures, mindfulness training, and cognitive behavioral therapy (CBT) techniques. It can give detailed instructions and motivation to put these approaches into practice.

- Support for therapists and clinicians: During sessions, ChatGPT can help mental health professionals by offering up-to-the-minute information and resources. It can help in taking notes, summarizing important information, or coming up with therapy suggestions based on the data provided by the therapist.

- Availability round-the-clock: ChatGPT is reachable 24/7, offering assistance and information even after regular business hours. People who are experiencing crises or who have trouble accessing mental healthcare treatments because of logistical or geographic restrictions may find this to be especially helpful.

Keep in mind that ChatGPT is an AI model and not a substitute for professional mental healthcare. Even though it can provide useful support and information, it should only be utilized when directed by qualified mental health professionals. The major goal of ChatGPT in the field of mental healthcare is to improve and enrich existing services, not to replace real therapists or clinicians.

Although ChatGPT has the potential to improve mental health care, there are several obstacles to overcome:

- Inability to comprehend context: ChatGPT could find it difficult to completely comprehend the subtleties, context, and underlying emotions of a conversation. This may cause misunderstandings or incorrect reactions, which could be harmful in delicate mental health circumstances.

- Privacy and ethical issues: Conversations with ChatGPT may include extremely sensitive and private information. It is essential to guarantee user privacy, data security, and ethical use of the information gathered during these interactions. To safeguard user privacy and stop data misuse, appropriate procedures must be put in place.

- Limited accountability: ChatGPT is not held accountable for its acts because it is an AI model. Accountability is crucial in mental healthcare to ensure that patients' emotions are

handled responsibly, that accurate information is given, and that ethical standards are followed. It is important to let users know that ChatGPT is an AI and not a certified expert.

- **Fairness and bias:** ChatGPT may unintentionally reflect biases present in the data it was trained on, which may result in biased responses. This might lead to disparate treatment or the reaffirmation of stigmas surrounding mental health. To address and reduce biases, careful observation, and continuing assessment are required.

- **Safety and crisis management:** While ChatGPT can provide help, it might not always be able to identify and handle a mental health crisis correctly. Human action and the availability of emergency resources are critical in crises. To ensure smooth transitions to human involvement, when necessary, certain rules and processes must be established.

- **Limited subject expertise:** ChatGPT can offer general information and support, but it might lack the specialized or clinical understanding necessary for some complex instances or mental health conditions. The ChatGPT's limits must be made clear, and users must be urged to seek professional assistance when necessary.

Continuous research, collaboration between mental health experts and AI developers, and advancements in the development and use of AI-based mental healthcare technologies are necessary to address these difficulties. Prioritizing patient safety, ethical issues, and the general well-being of people seeking mental health treatment is vital.

### 3.5. ETHICAL CONSIDERATIONS FOR AI IN MENTAL HEALTHCARE PRACTICE

The developers, creators, and users (including physicians and healthcare organizations) of AI technologies need to carefully address ethical challenges, despite the numerous practical advantages these technologies offer. The integration of AI tools and techniques in the healthcare sector, as discussed in this chapter, may introduce new possibilities for violating or questioning established ethical standards and legislation. One concern involves the introduction of additional risks that could compromise patient privacy, safety, autonomy, and trust. The introduction of intelligent autonomous care providers, such as robots or virtual entities responsible for monitoring symptoms and administering treatment, presents a novel scenario that demands thorough examination. The system must possess the ability to make decisions and take actions in line with relevant professional ethics rules and standards when interacting with care seekers. Handling challenging ethical dilemmas during the provision of care is crucial. To ensure the effectiveness of the design and implementation of these technologies, it is imperative for the designers, producers, and users to be conscious of the ethical considerations associated with their use.

*Table 1: Summary of Ethics Codes, Guidelines, and the use of Artificial Intelligent Care Provider (AICP) Systems: Considerations and Recommendations.*

1. Ensure appropriateness of the use of AICPs for intended clinical populations and the individual needs of patients.
2. Disclose what services and limits of services will be provided by AICPs.
3. Ensure that system users understand the capabilities, scope of use, and limitations of AICP systems and describe these to patients as part of the informed consent process.
4. Require human supervision and monitoring for adverse patient reactions and clinical contraindications when there may be a risk.
5. Display credentials and qualifications of both AICPs and care provider users.
6. Describe and disclose data use including the extent of data collection, access limitations, and disposition of data records.
7. Follow applicable privacy laws and rules.
8. Ensure that AICP system capabilities follow the latest established clinical best practices.
9. Ensure that the end of the patient-AICP interaction provides continuity of care and sensitivity to the emotional nature of the patient-AICP interactions.
10. Provide a mechanism for patients to ask questions and report complaints.

Source: (Luxton, 2014).<sup>56</sup>

When incorporating AI into the practice of mental healthcare, ethical considerations are essential. Here are some crucial ethical issues to take into account:

- **Privacy and Data Security:** AI systems are frequently used in the field of mental healthcare to gather and examine private data. It is crucial to guarantee that people's privacy is respected and that their data is transported and stored securely. To reduce the danger of unauthorized access or data breaches, rigorous access controls, encryption, and data anonymization should be used.

- **Informed consent:** Individuals should have the right to give informed consent and should be fully informed about the use of AI in their mental healthcare. They should be aware of the goals of AI interventions, the data gathered, how it will be used, any potential hazards or advantages, and their privacy rights. Clear and understandable methods should be used to get informed consent.

- **Transparency and Explainability:** AI technologies used in the field of mental healthcare should be clear and comprehensible. People ought to have access to details about how AI algorithm's function, what data is used, and how judgments are reached. This openness promotes responsibility, creates trust, and gives people the power to decide on their treatment in an informed manner.

- **Fairness and Bias:** When biases are present in the data used to train AI algorithms, this could result in discrepancies in care. When creating, honing, and deploying AI systems, efforts should be made to minimize prejudice and maintain justice. To identify and correct any biases that develop, algorithms should be continuously monitored and audited.



- **Human Oversight and Accountability:** While AI can improve mental healthcare, human professionals should still be in charge. To guarantee the precision, safety, and ethical implications of AI-driven actions, adequate human monitoring is required. Mental health professionals need to be accountable for their use of AI advice and take responsibility for judgments based on it.

- **Continuity and Discontinuity of Care:** AI should be integrated in a way that supports continuity of care and prevents services from being fragmented or depersonalized. It is critical to take into account how AI treatments fit into the larger system of mental healthcare, encourage cooperation with human clinicians, and sustain the therapeutic relationship.

- **Equity and Accessibility:** AI-powered interventions in mental healthcare should be planned and implemented in a way that encourages equitable access and reduces current gaps. Concerns including accessibility, technological limitations, and the requirements of varied populations should be taken into account. It is critical to prevent escalating current imbalances and make sure that everyone, regardless of financial background, race, or other demographic variables, benefits from AI.

- **Evaluation and Validation:** To assure the efficiency, security, and caliber of AI systems, rigorous evaluation and validation are required. To acquire data in favor of the use of AI in mental healthcare and to identify and address any potential hazards or restrictions, research studies, clinical trials, and continuing monitoring are crucial.

Collaboration between mental health practitioners, AI developers, politicians, and people with lived experience is necessary to address these ethical issues. Responsible AI integration into mental healthcare requires open communication, transparency, and a dedication to user-centric and morally sound procedures.

Professional healthcare institutions and governing bodies must keep up with technology advancements and adopt a proactive strategy to address problems before they arise. Regardless of their specific field, healthcare professionals, researchers, developers, and end users must collectively acknowledge and engage in discussions regarding the ethical concerns arising from the current and potential applications of these technologies. In the development of AI technologies for behavioral and mental health treatment, psychologists and other mental health practitioners will have the opportunity to collaborate with ethicists, engineers, and technology experts. This collaboration aims to ensure that these technologies are designed and implemented in a manner that aligns with ethical standards and responsibilities.

### 3.6. GAPS IN AI APPLICATIONS IN MENTAL HEALTH

Conducting research is essential to mitigate unpredictable behavior in AI applications. Before obtaining approval for clinical use, AI devices should undergo comprehensive risk assessments and adhere to the same stringent administrative controls as other medical devices. Rules must be followed when utilizing AI systems, whether for scientific or medical goals. These guidelines should include things like what to do if a patient has thoughts of harming herself or others, for example. Additionally, adequate safeguards for data protection and maintaining confidentiality must be made. According to several

studies, some users frequently communicate rudely with assistive technology than they would with a person. There is a remote chance that human-machine interactions will not translate to human-human interactions or may even further restrict human-to-human interactions. The results of AI research must therefore be repeated and confirmed.

### 3.7. FUTURE OF AI IN MENTAL HEALTHCARE

Several issues regarding the future of mental health care need to be addressed alongside potential solutions. As machine learning algorithms become integral in providing treatment to patients or aiding public health decision-making, it becomes crucial to ensure their alignment with the current practices of human professionals, including therapists and psychiatrists. Conflicts between human specialists and AI models, especially when prognostication based on algorithms deviates from clinical assessments, patient expectations, or self-reports, may arise and need to be managed.

While clinical decision support utilizing deep learning techniques proves beneficial in various healthcare settings, such as radiology, the mental health and psychiatry domains might find more advantages in weak AI. Weak AI allows for easier control of discrepancies and conflicts, emphasizing the need to develop diverse AI applications for specific tasks (e.g., triggering interventions vs. recommending therapy) or symptom categories (e.g., research).<sup>57,58</sup> Additionally, incorporating these algorithms into existing workflows raises concerns about skill acquisition. Researchers propose that the practical application of AI in psychiatry will require expertise from human experts in machine learning and AI models.<sup>59</sup> A novel concept suggests introducing new roles within the treatment ecosystem known as "digital navigators" to enhance the integration of AI technology in mental health care. Essentially, individuals in this role would act as intermediaries between technology and healthcare professionals, and subsequently, between technology and patients.<sup>60</sup> Future research should explore the minimal competency required for the safe integration of AI algorithms in point-of-care services and utilize this knowledge to empirically assess the necessity for additional healthcare positions like digital navigators.

Similarly, biometric recognition and emotion sensing can be of utmost importance in analyzing the mental well-being of patients. Currently, various devices like EEG headsets and health bracelets enable the collection of biometric data from individuals. The extensive datasets generated from monitoring EEG and physiology can be employed to deduce information about people's emotions and moods, among other applications. Eye tracking systems are now able to identify users' points of gaze when interacting in ICT settings in addition to directly measuring biometric signals, which adds value to research in a variety of fields like psychology or marketing.<sup>61</sup> The biometric recognition or emotion sensing through smartphones, wearable devices or specialized computer-based clinics can be analyzed with the help of AI and can help with early diagnosis of mental state of the patient, which can be used as an adjunct for the physician. Such early diagnosis can result in a better prognosis for the patients.

We recognize that the forthcoming landscape of mental health treatment, involving algorithms in decision-making, is poised to influence human-human relationships.<sup>62</sup> This impact may manifest through the therapeutic alliance between patients and clinicians or in the coordination among public health workers. Consequently, the implementation logistics need careful consideration. Therefore, as we assess the functionality of real-world machine learning systems in the long run, it is essential to be aware of the importance of preserving social relationships and safeguarding them from intricate interactions and compromised interpersonal boundaries.

AI in mental healthcare has a bright future and can completely change the industry. The following factors could influence how AI is used in mental healthcare in the future:

- **Personalized Interventions:** AI systems' capacity to evaluate enormous volumes of data and offer customized interventions will continue to improve. AI can give individualized treatment plans and interventions that are more successful and efficient by taking into account elements such as genetics, biology, environmental impacts, and personal preferences.
- **Early Detection and Prevention:** Thanks to AI's capacity to spot small patterns and alterations in linguistic, behavioral, and physiological data, mental health concerns may be discovered and treated earlier. AI systems can identify risk factors and offer prompt therapies by utilizing machine learning algorithms, thereby delaying the onset or worsening of mental health illnesses.
- **Digital Therapeutics and Virtual Reality:** Combining AI with digital therapeutics and virtual reality technologies has the potential to create interventions that are more immersive and engaging. While AI algorithms can provide real-time feedback and adapt to the virtual world based on individual responses, virtual reality therapy can imitate real-life circumstances to help people confront and control their phobias.
- **Natural Language Processing and Sentiment Analysis:** New developments in these fields will allow AI systems to learn more about people's mental states through their verbal and written language. AI can recognize emotional distress, pinpoint underlying problems, and offer the proper assistance and solutions by studying speech patterns, written texts, and social media data.
- **Collaborative Care:** AI can help mental health practitioners collaborate and coordinate more effectively. AI-powered platforms can facilitate care coordination between various clinicians, offer treatment recommendations, and aid in decision-making. AI and human specialists working together can improve the efficacy and quality of mental healthcare treatments.
- **Responsible and Ethical AI Integration:** As AI is used more frequently in mental healthcare, ethical issues will be of utmost significance. In AI systems, it will be crucial to provide privacy, data security, openness, justice, and cultural sensitivity. To safeguard people's rights and advance ethical AI integration in mental healthcare, rules, and laws will continue to develop.
- **More Seamless Integration into Existing Healthcare Ecosystems:** AI will be more smoothly incorporated into current healthcare ecosystems. AI skills will be progressively incorporated into mental health apps and platforms, which will offer a variety of services, from

self-help tools to remote treatment sessions. A more complete picture of a person's mental health will be available through integration with electronic health records, wearable technology, and other data sources, allowing for individualized therapies.

- **Research and Innovation:** The future of AI in mental healthcare will be driven by ongoing research and innovation. New insights, technologies, and solutions will continue to be produced through collaborations between mental health experts, data scientists, and AI developers. Real-world trials and longitudinal investigations will assist confirm the efficacy and security of AI-driven therapies.

Although AI has a lot of potential, it's crucial to keep in mind that it should support, not replace, human care. Finding the ideal harmony between technical breakthroughs and the human touch, while prioritizing ethical considerations, patient preferences, and cultural considerations, is key to the future of AI in mental healthcare.

## CONCLUSION

The interjunction of AI and Mental Health Care is pretty novel and can prove to be highly beneficial for humankind in the current era where mental health problems have risen to a substantial level. AI-based mental health therapies have received a lot of interest and have the potential to enhance conventional forms of therapy and support. There are incredibly few psychiatrists for the whole population in the current world, but almost everyone owns a smartphone, and very large populations can use a single AI system if they have access to the appropriate hardware, which is becoming more and more common. There are various AI-based interventions for Mental Health care, which have been listed above in the chapter. Some of them have been in use for quite some time while some are new and more study needs to be done to prove their efficiency.

Since the 1990s, chatbots have been employed for mental health disorders, with the majority of digital phenotyping research concentrating on depression and anxiety. VR technology has the potential to build immersive and participative therapeutic environments; recreating actual events that cause anxiety or phobias and allowing people to address and control their concerns in a safe environment. As ChatGPT and other AI platforms have a wide range of potential uses and are fast developing, there is a lot of potential for them in a variety of areas, including mental health. Smartphones and wearable devices can be of utmost importance if we target to reach the masses for these AI-based interventions. AI needs to confront challenges related to bias, privacy, transparency, and other ethical concerns, as it holds the potential to enhance the accuracy of mental disease diagnosis, identify conditions in their early stages, tailor medications, and empower patients in their healthcare.

While using AI, adequate precautions must be taken to protect data and maintain confidentiality. Rules must be followed when utilizing AI systems, whether for scientific or medical purposes and these instructions should specify what to do, for instance, if a patient has thoughts of harming him/herself or others. The gap between clinical treatment and AI in the field of mental health research needs to be bridged, thus caution must be used to avoid extrapolating too much from preliminary



results. Although AI has a lot of potential, it's important to remember that it should supplement human care rather than replace it. More research should be appreciated to know about further advancements in AI which can highly benefit us in the field of Mental Health Care.

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