

Exploring the Role of Artificial Intelligence in Mental Healthcare: Current Trends and Future Directions – A Narrative Review for a Comprehensive Insight

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Abstract: Mental health is an essential component of the health and well-being of a person and community, and it is critical for the individual, society, and socio-economic development of any country. Mental healthcare is currently in the health sector transformation era, with emerging technologies such as artificial intelligence (AI) reshaping the screening, diagnosis, and treatment modalities of psychiatric illnesses. The present narrative review is aimed at discussing the current landscape and the role of AI in mental healthcare, including screening, diagnosis, and treatment. Furthermore, this review attempted to highlight the key challenges, limitations, and prospects of AI in providing mental healthcare based on existing works of literature. The literature search for this narrative review was obtained from PubMed, Saudi Digital Library (SDL), Google Scholar, Web of Science, and IEEE Xplore, and we included only English-language articles published in the last five years. Keywords used in combination with Boolean operators (“AND” and “OR”) were the following: “Artificial intelligence”, “Machine learning”, “Deep learning”, “Early diagnosis”, “Treatment”, “interventions”, “ethical consideration”, and “mental Healthcare”. Our literature review revealed that, equipped with predictive analytics capabilities, AI can improve treatment planning by predicting an individual’s response to various interventions. Predictive analytics, which uses historical data to formulate preventative interventions, aligns with the move toward individualized and preventive mental healthcare. In the screening and diagnostic domains, a subset of AI, such as machine learning and deep learning, has been proven to analyze various mental health data sets and predict the patterns associated with various mental health problems. However, limited studies have evaluated the collaboration between healthcare professionals and AI in delivering mental healthcare, as these sensitive problems require empathy, human connections, and holistic, personalized, and multidisciplinary approaches. Ethical issues, cybersecurity, a lack of data analytics diversity, cultural sensitivity, and language barriers remain concerns for implementing this futuristic approach in mental healthcare. Considering these sensitive problems require empathy, human connections, and holistic, personalized, and multidisciplinary approaches, it is imperative to explore these aspects. Therefore, future comparative trials with larger sample sizes and data sets are warranted to evaluate different AI models used in mental healthcare across regions to fill the existing knowledge gaps.

Keywords: artificial intelligence, machine learning, early diagnosis, interventions and mental healthcare

Introduction

Mental health is an essential component of the health and well-being of a person and community, and it is critical for the individual, society, and socio-economic development of any country.^{1,2} According to the World Health Organization (WHO), action toward prevention and early intervention in mental health is urgently needed and indisputable.¹ The changes in lifestyle, work pressure, and academic pressure lead to more psychological problems among the common population. This scenario is global, irrespective of any continent.^{3,4} On one side, mental health problems are on the rise, and on the other side, healthcare related to mental health faces numerous challenges, such as access to mental health-related services, stigma, lack of human resources, financial allocation, digital divide, early diagnosis, and mental health of vulnerable populations.^{5,6}

The latest technologies, such as artificial intelligence (AI), have improved healthcare delivery significantly in different settings.^{7,8} Even though AI technology can be traced back to the mid-20th century, recent decades have witnessed significant growth in its usage in healthcare.^{9,10} AI in the healthcare sector decreases the workload of healthcare workers, makes a quicker diagnosis, and leads to efficient patient care, including care for mental health. It is estimated that the involvement of AI in healthcare in the USA may contribute to a decrease in healthcare expenditure by 150 billion USD by 2026.¹¹ Globally, mental healthcare faces numerous challenges, including lack of access to mental healthcare services, lack of mental healthcare professionals, fragmentation of care, resource constraints, and lack of funding.^{12,13} According to the American Psychological Association's new report, the need for mental healthcare professionals is on the rise, and they are unable to cater the service to new patients. This scenario is further worsened among the marginalized communities. Additionally, they stated that with the shortage of mental health professionals, digital therapies may be crucial in providing care for underserved populations.¹⁴ Over the period of time, from the first AI in mental healthcare, ELIZA, developed by Joseph Weizenbaum in 1966, there have been tremendous developments in AI technologies in mental healthcare, especially in the past decades. The recent development includes AI usage in almost all aspects of mental healthcare.^{15–17} Hence, mental healthcare, which is currently in the health sector transformation era with emerging digital technologies such as AI, is reshaping the screening, diagnosis, and treatment modalities of psychiatric illnesses.¹⁸ Machine learning (ML) and deep learning (DL) are AI subcategories that try to solve challenges related to mental health care. Mobile apps, virtual clinics, digital screening, relaxation apps, and digital treatments are some of the technologies often utilized in mental healthcare that garnered attention and were proven effective during and after the COVID-19 epidemic.^{19,20} Nonetheless, AI applications in mental healthcare possess their own demerits, such as privacy concerns, a lack of human interactions, and regulatory challenges. These concerns are making mental healthcare providers reluctant to use or refer their patients to AI. Hence, it is essential to understand current trends and gaps in knowledge of AI integration in mental healthcare. Therefore, policymakers can gain insight into the importance, cost-effectiveness, patients' expectations, and outcome of this critical public health issue. Considering the aspects mentioned above, the present review is aimed at discussing the updated landscape and the role of AI in mental healthcare, including screening, diagnosis, and treatment. Furthermore, we attempted to highlight the key challenges, limitations, and prospects of AI in providing mental healthcare based on existing works of literature. Finally, this narrative review identified existing knowledge gaps that give future research directions on AI in mental healthcare.

Literature Search Strategies

The literature search for this review was obtained from PubMed, Saudi Digital Library (SDL), Google Scholar, Web of Science, and IEEE Xplore. The following keywords were used separately and/or with combinations (Boolean operators), and keywords we followed as per medical subject headings were: “Artificial intelligence”, “Machine learning”, “Deep learning”, “Early diagnosis”, “Treatment”, “interventions”, “ethical consideration”, and “mental Healthcare”. The present literature review included only published English-language articles from the past five years and excluded expert opinions, research not relevant to healthcare, case studies, grey kinds of literature, and articles published before 5 years. The bibliography aspects of the relevant full-text research studies were also looked upon to find more pertinent articles. The strategies followed in each step to include and exclude the articles are depicted in the [Supplementary File](#) (Please find [Appendix A](#) for more details).

Main Text

The summary of some essential studies related to AI and its uses in diagnosis and treatment is presented in [Supplementary Table](#) (Please find [Appendix B](#) for more details).

AI Applications in Screening, Diagnosis, and Treatment

This section discusses the current scenario regarding the development of AI-driven technologies for mental health and their potential to improve the diagnostic capacities of psychiatric diseases.

Early Detection and Diagnosis

Abdel-Razzaq et al evaluated the effectiveness of AI in different psychiatric illnesses regarding early diagnosis and screening. The authors evaluated the effectiveness of AI models in diagnosing mental health disorders such as cognitive impairment, schizophrenia, and bipolar disorders. They reported that the effectiveness of the AI models in diagnosing psychiatric illnesses ranged from 21% to 100%, and their study metrics indicate a promising future for AI in this discipline. Furthermore, AI applications provide promising results in diagnosing psychiatric illnesses. Abd-Razzaq et al concluded that mental healthcare providers must start learning about the potential of AI-based approaches for their daily clinical practice, and for effective implementation, a higher level of evidence is imperative in this discipline.²¹ Liu et al, 2020, who explored the changing field of AI technology as applied to mental health, speculate about the impact on diagnostic procedures. They stated that AI's scope is broad and up to date while pointing out the value of AI in assisting early detection and diagnosis in psychiatry. Furthermore, existing AI model can process only homologous datasets and its generalizability is inadequate.²² On evaluating the use of DL algorithms in psychiatric illness diagnosis, Rajendran et al and Su et al stated that DL algorithms can improve mental health professionals' understanding of psychiatric illness and suggest various possible uses for providing mental health diagnosis and treatment.^{23,24} Tutun et al discuss using a decision support system AI model to predict and identify mental health problems, question the value of full-dimensional early diagnosis and screening, and give some ideas about how AI-based decision support systems for mental illness disorders may affect the capability of predicting mental health issues. Their study findings found that the proposed AI model can diagnose about 90% of mental disorders using 28 questions, and they concluded to use it as a supporting tool for improved clinical decision-making. Furthermore, the authors stated that the mental healthcare providers can increase the number of individuals appointments per day. Nonetheless, the authors stated that they used only a single web portal named "Psikometrist" to synthesize the study findings.²⁵ Alowais et al look at applications of AI in the early detection, screening, and diagnosis of mental illness. According to their findings, clinical practice needs to be more effective and accurate, and the viewpoint of the review is that in this regard, the prospects for AI in health care are revolutionary. Furthermore, they concluded that AI can be applied to diagnose, formulate personalized plans, and support physicians with decision-making.²⁶ A study by Kalmady et al evaluated the diagnostic accuracy of the AI model "EMPaSchiz" based on resting scale functional MRI. This approach combines predictions from many "single source" models, which are based on regional activity and functional connectivity factors, using various predefined parcellation techniques. They reported that higher accuracy (about 90%) in classifying schizophrenic patients who were on antipsychotic medicines than earlier models.²⁷

AI and psychiatry by Ray et al discuss the use of AI in mental healthcare and its advantages, raising the possibility that it will reform mental healthcare. Although still preliminary, the study provides some understanding of how AI applications might affect psychiatry.²⁸ Science Insights (Shimada 2023) discusses the relationship between artificial intelligence and mental health and the importance of early diagnosis and screening. In their study, the transformation of AI-based methods can be seen to a small degree. It demonstrates that they play an important role in early diagnosis and screening for mental health problems.²⁹ On evaluating the uses of AI in mental and gynecological healthcare, Delanerolle et al highlighted that in gynecology, obstetrics, and mental health practice, capabilities in deep learning need to be enhanced to make women's health more personalized and to see more favorable results. Therefore, early diagnosis and screening are as important as ever, emphasized Sun et al in 2023.^{30,31} Sun et al focused on AI and psychiatric care and discussed applications and implications for research and clinical practice. The findings provided a glimpse into the changing face of AI in psychiatry regarding diagnosis and therapeutic intervention. Other significant findings that hinder the use of AI in screening and diagnosing mental health are the lack of adequate studies that integrate large-scale data, the use of large language models, and the heterogeneity of data.^{32,33}

An interesting study by Zhang et al in 2023 evaluated the effectiveness of the Multiple Instance Learning AI model based on the MRI protocol among their study participants. They conducted a real-world analysis of various clinical MRI scans to evaluate the predictive utility of their proposed model. Their findings suggest that the digital model can be used to identify people with severe mental illness with high accuracy. However, the authors stated that considering medical students as their study participants, with a high possibility of increased stress among them compared with the general population, the generalizability of their study findings is limited.³⁴ Aich et al report that AI can enhance the accuracy of diagnosis, remove discrimination, and raise the standards of care. Their study concluded that AI technology and its

existing applications in mental illness, as well as a discourse on how AI can support patient care. However, Aich et al suggested considering the AI's limitations, challenges, and moral aspects.³⁵ Graham et al explored the possible roles of AI in the early diagnosis, screening, and treatment of mental illness. According to their study, the growth in AI usage in mental healthcare cannot be ignored. Their research focuses on the four major mental health issues, namely, depression, anxiety disorder, bipolar disorder, and post-traumatic stress disorder. Graham et al summarized AI's potential in mental healthcare. They stated that AI techniques can help mental health practitioners redefine psychiatric illness more objectively than DSM-5.³⁶ In mental healthcare, Lee et al explored the clinical applications of AI. Early diagnosis and screening come under the spotlight in the study, and it also discusses the obstacles and opportunities and the idea of an "artificial mind". It indicates the hope for AI as a new mode of remolding mental health care on the one hand and points out the difficulties in introducing AI to mental health.³³ A critical finding identified by Rosenfeld et al after integrating large-scale data is the need for gold-standard diagnosis from AI in mental health, as clinicians and researchers often rely on diagnosing some diseases, such as in oncology.³⁷ Sharma and Verbeke evaluated the significance of some selected biomarkers in anxiety disorder. Machine learning techniques assessed these biomarkers among Dutch populations. They revealed that machine learning techniques were practical to find the correlation between these biomarkers and anxiety disorders. However, these findings might be limited to the local population. They recommended conducting future studies based on making a perfect classification model with a more extensive dataset and more variables presented in their research.³⁸ Another important study by Xu et al evaluated the effectiveness of multimodal models that recognize voice, facial expression, and so on. The observed occurrence of depression, anxiety, and stress is constant with the multiple targeted tests used in their study. The authors suggested using a multimodal emotion recognition model in large-scale mental health screening programs. However, their study findings are limited by the possibility of sampling bias and the low discriminant validity of the tool used.³⁹

Early Interventions and Treatment

Using AI to treat and intervene in mental health disorders constitutes a revolutionary shift in how we approach the landscape of mental illness. This review of recent developments and discoveries in the many-faceted applications of AI looks at how it has been used to improve treatment methods as well as explore impactful interventions for mentally ill patients.

With recent advances, AI has helped to promote personalized treatment plans through intelligent algorithms. These algorithms are used to analyze patient information by correlating their genetic, lifestyle, and environmental variables to determine the best and most affordable treatment for each patient. This method improves the effectiveness of treatment and care and minimizes the side effects, surpassing the old one-size-fits-all method.⁴⁰⁻⁴² Ahmed et al created a multi-functional machine learning platform for precision medicine, and the data depicted the importance of maximum use of electronic medical records by involving diverse data sources. It also emphasized the use of specific, personalized treatment and necessary intervention.⁴³ Whereas Noorbaksh-Sabet et al highlighted the potential use of AI in transforming mental health care, this paper also explored the use of AI technology in bringing novel remedies and better patient outcomes.⁴⁴

Digital tools like virtual therapists and chatbots in AI technologies help to enable the scale-up and accessibility of various therapeutic interventions. These tools utilize natural language processing and machine learning to associate with users in real-time. By creating a risk-free, de-stigmatized space for users to open up and express themselves, virtual interventions achieve this. In addition, they deliver immediate information and coping strategies.^{45,46} Wrightson-Hester et al evaluated the use and acceptability of the Manage Your Life Online (MYLO) AI chatbot among young adults (16 to 24 years) with psychological illness. The MYLO application was developed from the experience of a progressive web application. Preliminary results indicate that MYLO has the capacity to enhance the mental well-being of adolescents and empower them to independently address their own challenges. However, the authors indicated that their study findings should be interpreted cautiously as they were not based on more advanced analysis (inferential), and the follow-up duration was also short (14 days). Hence, the authors aim to conduct futuristic trials on a larger sample size. They concluded that the developed chatbot helped their participants overcome their mental health problems.⁴⁷ A randomized controlled trial conducted by D'Alfonso et al on the use of AI-assisted social media therapy for handling the mental health of youth revealed a positive viability in their ongoing trial. However, they suggested conducting the trial on a large scale as an essential next step.⁴⁸ Nosrati et al indicate many potential benefits of digital technologies in mental health and some possible discontent.⁴⁹ Van der Schyff et al aim to address the increasing demand for mental health care. It points to

the power of AI in this regard through unique, self-run interventions, highlighting the role that technology plays in helping promote mental health. The AI-powered Leora model is seen to have the ability to give mental health support to patients with mild to moderate anxiety and depression. The authors emphasized that these AI users' data is highly secured through cloud services provided by Amazon Web Services, Inc. Furthermore, the Leora AI model also acts as an interlink between patients and care providers. Finally, the developers must stay alert and cautious to avoid clinical or user experience bias. Furthermore, it is crucial to prioritize equity, especially for individuals with little health-related knowledge, non-native speakers, or individuals with disabilities.⁵⁰ A study by Thieme et al stresses the critical role of AI in improving mental health interventions. To ensure effective and meaningful usage in therapy, it is crucial to have a user-oriented AI.⁵¹

A randomized control trial in the USA conducted by Sadeh et al discovered the impact the AI platform has on depression and anxiety-related symptoms. They compared conventional (treatment as usual) and the AI platform provided by Eleos Health. Their results provided crucial information on the effectiveness of AI-based interventions for mental health issues and in reducing their symptoms.⁵² It was important to look at the user compliance and perceptions of the application for cognitive-behavioral therapy, which were recorded by Malik et al. This study took positive feedback from the "Wysa app" users which revealed comfort, a supportive environment, and safety for users. However, Malik et al's findings are limited by single source (Google app) data, a lack of demographic data, and a lack of app usage.⁵³ In another paper, Noorbakhsh-Sabet et al explore how AI technologies can change the mental healthcare landscape, bringing novel remedies and better patient outcomes. These findings highlight AI's potential role in transforming mental health care.⁴⁴

The study by Ebert et al is an excellent complement to the present Special Series on psychotherapy. It provides an overview of the current state of digital mental health interventions and an introduction to their potential to improve the efficacy of treatment and intervention strategies through AI.⁵⁴ The measuring fidelity in supervising psychotherapy and acceptance and perception of AI tools was given by Creed et al. This study also explains that AI can improve the quality of any psychotherapy.⁵⁵ Mohsin et al findings highlight AI's potential to revolutionize mental healthcare and intervention by enhancing diagnostics, treatment personalization, and overall healthcare efficiency.⁵⁶ A transformation in mental treatment and intervention is discussed in research by Schwalbe N. and Wahl B. (2020), which discussed AI in improving accessibility, personalized care, and diagnostics.⁵⁷ Their findings indicate the usefulness of AI in low- and middle-income countries, even though they have limited resources.

Sentiment Analysis and Predictive Analytics in Mental Healthcare

AI and its crucial role are explained in sentiment analysis and predictive analysis. People's mental status can be predicted by Sentiment analysis through techniques like natural language processing and machine learning technologies, where emotional nuances are extracted from various texts and sources.³⁴ On the contrary, predictive analysis uses algorithms for assessing mental illness by examining historical data. It enables early intervention and personalized care. This domain can improve the treatment plan by predicting a patient's response to various interventions and also enabling the clinician to select the best treatment for his patients based on machine learning models, patient history, and treatment results.⁵⁸

AI in Sentiment Analysis in Mental Healthcare

AI plays an important part in sentiment analysis within mental health care. For example, analysis using AI algorithms-based machine learning and on natural language processing (NLP) techniques has shown that it is possible to discover the subtle emotional inflections related closely to mental health by analyzing large volumes of social media posts, as stated by Le Glaz et al. The authors concluded that ML and NLP may provide various aspects of mental healthcare and research. Nonetheless, these models can be used as complementary techniques, not as replacements for mental healthcare providers, as the patient-healthcare provider's relationship is critical.⁵⁹ In fact, AI systems can recognize linguistic signals related to depressive symptoms or heightened anxiety levels; such technology enables objective and scalable evaluation of mental health issues.⁶⁰ Additionally, the application of AI in sentiment analysis can capture a range of emotions and provide us with an all-round image of people's mental health conditions. This more refined outlook regards AI as a handy instrument for psychiatrists to complement their knowledge and improve the depth, scope, and breadth of treatment that can be offered to individuals whose emotional needs are constantly renewed from moment to moment.²⁸

Purgato et al suggested that conducting qualitative studies involving AI beneficiaries (users), family members, and other stakeholders could be beneficial before planning any intervention methods in mental healthcare.⁴¹

AI-powered sentiment analysis tools can be applied to therapy sessions and provide mental health professionals with a clearer understanding of patients' emotions. By analyzing patterns of language, tone, and sentiment in real-time, these tools are able to dynamically assess the emotional fluctuations within therapeutic interactions. Sentiment analysis can also be used in treatment planning and intervention strategies. Making use of the insights generated by AI, mental health professionals can assess what a patient needs most emotionally at this time and tailor interventions accordingly.⁶¹ Such an approach is more responsive and personalized than traditional methods that are offered to patients.

AI in Predictive Analytics in Mental Healthcare

The use of AI in predictive analytics has already been validated through compelling objective evidence. For example, predictive analytics can be used in research to prospectively identify mental health outcomes through the use of demographic information, treatment history, and psychosocial factors.⁵⁸ Besides the power of prediction, AI is also clearly proving its worth in terms of prevention, paving the way for a profound change in mental health care. AI systems may also be applied to find the not-so-obvious and occasionally missed early signs of mental illness.³⁴ Some of the early signs may include changes in speech, sleep, or social relations. With this finely honed understanding behind them, AI technologies give the healthcare industry a proactive toehold that allows for intervention to be done in time before neural networks are further exacerbated.⁶² Moreover, this approach has the potential to lessen the burden on mental health services by reducing demand for more expensive and intensive interventions.

In conclusion, AI in mental health care has great prospects. Sentiment analysis and predictive analytics are just two examples of the many promising areas for their use. The analytical advantages of AI can improve early diagnosis and individual treatment. Predictive analytics, which works with historical data to formulate preventative interventions, is in line with the move toward individualized and anticipatory mental healthcare. Further innovations must be informed by considerations of ethics to ensure the responsible and productive integration of AI.

Challenges and Ethical Considerations in Implementing AI in Mental Healthcare

AI has a great opportunity in the fields of mental health prediction, personalized treatment plans, and compliance assessment. A recent study conducted by Petersson et al in 2022 demonstrated several challenges in implementing AI in mental health care, which are beyond organizational control. Therefore, it is critical to involve all stakeholders, including the users, before providing the service for the successful implementation.⁶³ Furthermore, no matter how advanced AI may be, it cannot recognize the delicate nuances of human feeling. Mental illnesses may involve complex feelings and nonverbal communications that are hard for a machine to recognize. In addition, while AI has tremendous potential for narrowing health inequalities, it is not without some worrying aspects about its use in healthcare.⁶⁴ The AI algorithms used in medical risk evaluations, for example, are affected by historical data bias and tend to underestimate the chances that a certain minority group will contract a medical condition. The link between algorithmic bias and unfair treatment, not to mention health disparities among minority groups, is also apparent. According to a recent report published by the Imperial College of London, AI may further deteriorate the healthcare disparity among the ethnic minority population of the UK.⁶⁵

In addition to personal health condition information, running healthcare AI systems requires huge amounts of very sensitive patient data. Some authors stated that data that has been breached is still usable and can even be misused. The cybersecurity of mental health data is a critical factor to be considered while implementing AI in mental healthcare.⁶⁶ Mental health data breaches can cause various problems for victims and their families. Cyber-attacks, for example, have the potential to aggravate several psychological disorders, such as anxiety, depression, or even suicidal tendencies. For example, a study performed by Mateu et al reported that cyberbullying is associated with several types of posttraumatic disorders.⁶⁷ Some authors have quoted the repetition of these cybersecurity issues in mental health as "cyber-trauma."⁶⁶ Moreover, biased training data can lead to inaccurate predictions and perpetrate the inequities already existing in mental health care.^{68,69} According to Golden et al, the progress of AI models alone is insufficient to eliminate structural racism and tackle healthcare inequities. It is necessary to take action at various levels to solve these issues. The authors concluded there is no single solution to solve this issue and suggested utilizing the Remove, Repair, Restructure,

Remediate (R4P) approach combined with the Retrofit, Reform, and Reimagine (3R) model to address multiple forms of racism.⁷⁰ Although AI is a useful tool, human interaction (which helps provide many forms of mental health care) cannot be replaced by it. Also, the way AI is being used in mental health raises regulatory and legal concerns. When AI makes a mistake or an incorrect diagnosis, it's hard to know who has the responsibility for such errors. It is imperative that legal norms and frameworks be spelled out in great detail.⁷¹

The ethical considerations of AI interventions for mental health are also important. Unfortunately, many patients are not aware of the consequences that may result from using AI systems for medical diagnosis.^{71,72} However, before using AI mental health products and services, people have to give their informed consent about the capabilities and limitations of these systems. However, concerns regarding informed consent and patients' autonomy are still questionable while using AI in healthcare.⁷³ Furthermore, since mental health treatments must be available and affordable to all population groups, efforts should also be made to make sure that the algorithms on which AI is based are not biased.⁷⁴ Gathering a large, representative training data set and monitoring the bias in their algorithms are critical for the AI developers to ensure they work fairly and accurately. Moreover, human monitoring is needed in the event of discrimination. In addition, AI-based mental health solutions need to have clearly defined responsibilities and objectives.⁷⁵ On the other hand, for AI developers and medical professionals as well as regulatory agencies, it is about fixing responsibilities between each party in cases where outcomes are unsatisfactory or unethical behavior might be involved.^{6,64,73,76}

Culturally sensitive AI systems must be aware of differences between cultures and should take different kinds of culture into account. A one-size-fits-all solution will not suit everybody.^{41,42} As stated earlier, rising mental health problems are a global issue. However, cultural aspects of mental health problems need to be considered, as they play a vital role in reshaping AI mental healthcare delivery. According to the Mental Health Commission of Canada, AI developers and stakeholders must consider culturally sensitive AI algorithms for mental healthcare.⁷⁷ Furthermore, the language barrier is another important ethical issue that has been observed by several authors. Providing AI application services in multiple languages could be beneficial and break one of the significant barriers to mental healthcare.⁷⁷⁻⁷⁹ Moreover, patients and healthcare professionals must be aware of the ethical implications of AI for mental health. It means being alert to the risks, opportunities and ethical questions that AI-driven solutions raise.^{33,76} Furthermore, organizations collecting patients' information must protect the data by instituting robust security systems to prevent unauthorized access and leakage of sensitive data.^{69,76}

Knowledge Gaps and Future Research Directions of AI in Mental Healthcare

Even though scientific societies demonstrated several revolutionary innovations in AI in mental healthcare delivery, especially during past decades, this narrative review uncovers several unexplored aspects that give insights for future research. Those aspects are summarized below.

- a. Numerous studies have demonstrated the ethical concerns such as privacy, data security, and autonomy linked to AI in mental healthcare. However, exploratory studies aimed at solving these ethical problems are limited.
- b. Several psychiatric problems, such as schizophrenia, are lifelong illnesses and require long-term follow-up regarding patients' satisfaction, adherence to therapy, and so on. Despite these facts, the existing evidence on AI's role in mental healthcare is based on short-duration follow-up. This indicates a significant knowledge gap and necessitates the need for prospective cohort studies for a longer duration to understand changes in patients' symptoms over time.
- c. Most of the available works of literature are based on a single app or web portal application. Furthermore, the smaller sample size or smaller data set limits most of the study's findings. Therefore, future comparative trials with larger sample sizes and data sets are warranted to evaluate different AI models used in mental healthcare across regions.
- d. It is evident that a "one-size-fits-all mental health solution" will not suit everybody. Therefore, personalized approaches are needed according to patients' sociocultural and demographic characteristics.

- e. Finally, mental healthcare involves the principles of the multidisciplinary team approach. Therefore, it is critical to evaluate the perceptions and viewpoints of all stakeholders in mental healthcare, including end-users (patients), before widespread applications of AI in mental healthcare. However, the review could not find sufficient evidence on this aspect. Hence, future research is warranted in this context before implementing this futuristic healthcare delivery in widespread use.

Conclusion

The application of AI in mental health care has excellent prospects and is more promising than ever. This review explored that sentiment analysis and predictive analytics are just two examples of promising areas for use in mental healthcare delivery. This narrative review identified that ethical issues, cybersecurity, a lack of data analytics diversity, cultural sensitivity, and language barriers remain concerns for implementing this futuristic approach in mental healthcare. Considering these sensitive problems require empathy, human connections, and holistic, personalized, and multidisciplinary approaches, it is imperative to explore these aspects. Therefore, future comparative trials with larger sample sizes and data sets are warranted to evaluate different AI models used in mental healthcare across regions to fill the existing knowledge gaps.

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