ARTIFICIAL INTELLIGENCE AND MENTAL HEALTH SERVICES

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ABSTRACT

Artificial Intelligence (AI) is progressively being applied in services of mental health to provide improved assessment, diagnosis, support, and treatment. This systematic review article aims to search the current literature on the use of AI in mental health services, focusing on the effectiveness of AI-based interventions and the ethical considerations surrounding their use. The databases PsycINFO, web of Sciences, and PubMed, were explored for articles published between 2015 and 2022 using the following search terms: "Artificial Intelligence", "Mental Health", "Intervention", and "Ethics". A search based on inclusion and exclusion criteria ended up with 50 articles highlighting the possibility of AI to improve the effectiveness and accessibility of mental health services. Further deliberation excluded 30 articles and the present systematic review has been carried out with twenty articles. PRISMA guidelines were followed to formulate the results of this systematic review. The results suggest that AI-based interventions have auspicious outcomes for improving the diagnosis and treatment of disorders related to mental health, early detection and prevention of mental disorders, improved quality of care as well as reduced cost of mental health services. However, ethical considerations, such as privacy and transparency, must be considered in the application of AI in mental health assistance, and issues related to empathy and reflective practices were also highlighted. Implications and future directions for the research were also discussed.

Keywords: Artificial Intelligence, Mental Health, Intervention, Ethics.

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INTRODUCTION

Mental health disorders are a foremost public health concern worldwide, affecting approximately 1 in 4 people globally.[1] Despite the availability of various mental health services, there are significant barriers to access, such as stigma, geographic isolation, and limited resources.[2] In contemporary years, there has been rising interest in using Artificial Intelligence (AI) to provide innovative solutions to these challenges.[3]

AI describes using computer techniques to execute tasks that would characteristically require human intelligence, like solving problems, creative thinking, and decision-making.[4] AI could alter mental health services by granting more efficient and available solutions for diagnosis, treatment, and support.[5] While AI-based interventions have the potential to improve mental health services, several potential disadvantages and limitations should be considered.

An important point of concern with the source of AI in psychological health services is the potential for bias and discrimination. If the algorithms used to develop and implement AI-based interventions are not properly designed and validated, they may perpetuate or even amplify existing biases in the data or the healthcare system more broadly. Benjamin (2019) found that an algorithm commonly used in healthcare settings to predict future healthcare costs systematically underestimated the healthcare needs of Black patients, leading to lower-quality care.[6]

Another potential disadvantage of AI-based interventions is the lack of transparency in the decision-making process. Machine learning algorithms can be complicated to understand, which can make it opposing for clinicians and patients to comprehend how treatment suggestions are being made. This lack of precision can also make it difficult to recognize and assume errors or biases in the algorithm. Confidentiality and protection are additionally important points when it comes to the use of AI in mental health

services. AI-based interventions may require access to sensitive personal information, such as medical histories and behavioural data, which could be vulnerable to data breaches or misuse. Additionally, the use of AI-based interventions may raise concerns about the potential for surveillance and monitoring of individuals with mental health disorders, which could erode trust in healthcare providers and discourage individuals from seeking treatment.[7]

World Health Organization[1] has found that while AI has the latent ability to improve mental health care, there are substantial moral, privacy, and data protection issues that are important to take into consideration that AI is used dependably and effectively in this field. The study also highlighted significant errors in the use of AI in research related to mental health, implying an overly enhanced elevation of AI models without measuring their real-life capability. The study found methodological and quality flaws, unbalanced use of AI, and a substantial gap in identifying how it can be used to study all conditions related to mental health. The lack of transparency and methodological flaws delay AI's safe and practical implementation. The WHO launched a plan of action for the years 2023-2030 recognizing the need for improvement in prognostic analytics for improved health with the help of AI and big data. Experts urge policymakers to promote transparency, address flaws, and ensure the real-world viability of AI models.

AI chatbots have become increasingly popular as a tool for providing mental health therapy. These chatbots are designed to mimic human conversation, and they can provide therapeutic interventions like cognitive-behavioural therapy (CBT) to users in need of mental health support. The benefits of using AI chatbots include their accessibility, affordability, and convenience, but there are also concerns about their effectiveness and the potential risks associated with relying solely on these chatbots for mental health care. Many mental health professionals and patients see the potential benefits of using AI chatbots for mental health therapy. Chatbots can provide users with immediate access to mental health care, and they can be programmed to provide interventions that are tailored to the individual needs of each user. As technology continues to improve, we will likely see even more progressed AI chatbots that can provide more personalized and effective mental health care.[8]

One major challenge is ensuring that these chatbots are designed and programmed appropriately to provide effective interventions. There is also a concern that chatbots may be lacking the reflective practices that a human therapist can provide. Additionally, there are concerns about privacy and data security, as users may be hesitant to share sensitive information with a chatbot.

Finally, it is important to consider the potential for AI-based interventions to further broaden present disparities in access to services related to mental health. While AI-based interventions have the potential to provide remote contact to mental health services for persons who may not otherwise have access, they may also require access to technology or high-speed internet, which could create additional barriers for individuals who are already marginalized or disadvantaged. Overall, while AI-based interventions hold promise for improving mental health services, it is imperative to advance their progress and implementation with caution and thorough significance of likely ethical, privacy, and equity concerns.[9]

This systematic review article aims to explore the current literature on the use of AI in mental health services, focusing on the effectiveness of AI-based interventions and the ethical considerations surrounding their use.

METHOD

Research question: The research question for this systematic review is "What is research-based evidence related to AI application in mental health services, including diagnosis, early detection interventions, therapeutic outcomes, prevention, and ethics?

Search strategy: The databases PsycINFO, web of Sciences, and PubMed were examined for articles published between 2015 and 2022 using the following search terms: "Artificial Intelligence", "Mental Health", "early detection" "Intervention", "prevention", "big data" and "Ethics". The search strategy was designed to identify peer-reviewed articles that discussed the use of AI for services related to mental health, diagnosis, early detection, interventions, ethical considerations, and therapeutic outcomes.

Inclusion criteria: The inclusion criteria for this systematic review were peer-reviewed articles that discussed the use of AI in mental health services, diagnosis, early detection, interventions, ethical considerations, and therapeutic outcomes. Articles were required to be published between 2015 and 2022 and available in the English language.

Exclusion criteria: Articles were excluded if they were not peer-reviewed, did not discuss the use of AI concerning mental health, diagnosis, and early detection, interventions, ethical considerations, and therapeutic outcomes, were not published between 2015 and 2022, were not available in English, or were duplicates.

Selection process: The initial search yielded 234 articles. Three independent reviewers assessed the topics and articles' abstracts to determine their suitability for inclusion in the review. Full texts of the articles that met the inclusion criteria were then evaluated for relatedness.

Data extraction: Data extracted from the selected articles included information on the study design, sample size, AI techniques used, mental health conditions targeted, outcomes measured, and ethical considerations. Three independent reviewers obtained data from the articles, and any discrepancies were determined through discussion.

Quality assessment: Selected articles were assessed by two independent reviewers for their quality, research

design, inclusion/exclusion criteria, and many other factors. Any discrepancies were resolved through discussion.

Data synthesis: To summarize the findings of the selected articles a narrative data synthesis method was used. The findings were categorized based on the use of AI in mental health services, diagnosis, early detection, interventions, therapeutic outcomes ethical considerations.

Reporting: PRISMA guidelines were followed in reporting the results of this systematic review. The findings of the review were presented in a narrative synthesis.

RESULTS AND DISCUSSION

Diagnoses and Intervention: AI can also help mental health professionals make more accurate diagnoses and recommendations for interventions, by providing them with access to large amounts of data and analysis that can help them identify patterns and trends in their clients' symptoms.

Fitzpatrick, Darcy, and Vierhile aimed to investigate the possibility, suitability, and efficiency of a fully automated conversational agent (Woebot) that was designed to execute a self-help program to alleviate depression and anxiety symptoms of college students. The study recruited 70 participants, randomized into two groups: the Woebot group and an information-only control group. The results showed that participants in the Woebot group spoke with the conversational agent a usual 12.14 times throughout the study interval and notably reduced their signs of depression. Both groups significantly reduced anxiety. Participants' comments suggest that it was the process that was rated high as compared to the content of the program, resembling traditional therapy. The study concludes that conversational agents can be a viable, connecting, and efficient way to deliver CBT.[10]

A study investigated the potential use of Virtual Reality (VR) technology in facilitating mindfulness practice. The study participants who were mindfulness experts, listened to digitized Dialectical Behavioral Therapy (DBT®) mindfulness instructions while floating down a 3D virtual river wearing headsets. The participants reported that their negative feelings like anger, sadness, and anxiety were reduced, and mindfulness and pleasant feelings were enhanced. They also reported being considerably calmer after the VR mindfulness training session. The participants found VR technology to be an acceptable and useful technique for practicing mindfulness, and the study suggests that VR could be a promising tool for increasing the dissemination of DBT® skills training. Additional research is mandatory to investigate the efficacy of VR-based mindfulness training.[11]

Neuropsychological tests are crucial for diagnosing cognitive impairment, but interpreting the results is time-consuming and requires specialists. To simplify the process, researchers developed a machine learning algorithm using multi-center NPT data. The algorithm achieved high accuracy in identifying cognitive impairment and predicting cognitive states. The most important features were the "time orientation" and "3-word recall" scores of the MMSE test. By reducing the number of features to 12, the algorithm achieved over 90% accuracy. The outcomes suggest that the algorithm has the prospective to be a useful reference for diagnosing cognitive impairment in clinical settings.[12]

Major depressive disorder is a preceding cause of incapacity, but the trial-and-error process of finding an effective antidepressant can take months to over a year. Researchers have developed a deep learning model to predict whether an individual patient will respond favourably to bupropion, a commonly prescribed antidepressant, using only pre-treatment imaging data. The model achieved high accuracy and identified bupropion-treated patients who would experience remission with an NNT of 3.2. This approach may help expedite treatment selection and reduce morbidity for patients with major depressive disorder.[13]

This study aimed to investigate the effectiveness and acceptability of two different treatments for specific phobias: in vivo exposure and augmented reality exposure. The study was conducted in a randomized controlled trial with participants receiving either in vivo exposure or augmented reality exposure. Results showed that both treatments were effective and well accepted by participants. While in vivo exposure was found to be slightly more effective post-treatment, the differences between the two treatments disappeared at three- and six-month follow-ups. Overall, the study suggests that augmented reality exposure can be efficient and acceptable management for specific phobias.[14]

Electronic health records (EHRs) have the potential to revolutionize clinical investigation and management, but tasks in organizing and demonstrating patient data have hampered progress in predictive modeling using EHRs. To address this, a team of researchers developed a novel unverified deep attribute learning method using a three-layer pack of denoising autoencoders to describe reliabilities and dependencies in EHRs from nearly 700,000 patients. The resulting patient interpretation, called "deep patient," was evaluated for its ability to predict the likelihood of patients developing various diseases. Results showed that the deep patient representation significantly outperformed those established on authentic EHR data and other feature learning methods, specifically for forecasting acute diabetes, cancers, and schizophrenia. These results imply that great knowledge applied to EHRs could provide an effective machine-learning framework for increasing clinical decision-making techniques.[15]

As the amount of health data grows, machine learning is becoming increasingly valuable in the diagnosis process. It can be used to organize and analyze health data, allowing healthcare organizations to make more informed and timely decisions. This includes accurate diagnosis using genomic sequencing, early recognition of cancer, and developed visualization of heart conditions employing machine

learning models. Specialized health AI services can promptly transmute health data, enabling clinicians to speed up diagnoses and provide early treatment.

Assessment and prevention of psychological disorders AI can also assist in the assessment and prevention of psychological disorders. By analyzing large data sets, AI algorithms can identify possible risk factors and alarming signs of mental health problems. The onset of mental health disorders could be prevented by enabling early intervention and treatment. Stigma reduction could also be possible with the use of AI linked with mental health disorders by supplying undisclosed and classified access to mental health services. The study aimed to build a machine learning model for phenotyping psychiatric diagnosis to accurately find appropriate nominees for a research study on depression in young adults. The researchers used electronic medical records (EMR) documents and coded them by removing personally identifying information. They trained a deep neural network using a brute force search method, resulting in a model with 45% sensitivity and 97% specificity, and a second model with 89% sensitivity and 53% specificity. They united these models to generate a list of the most suitable candidates with a sensitivity of 93.5%, specificity of 68%, and positive predictive value of 77%. However, the study emphasizes the need for a greater sample size to build a more dependable reference system. Future endeavors will involve using alternating neural network algorithms and other machine-learning approaches.[16]

Mental illness is becoming more prevalent, leading to increased healthcare costs and reduced productivity. Electronic health records are commonly used to analyze psychological health, but they don't capture patients' experiences. Social media platforms like Reddit provide daily exchanges on mental health topics, offering an opportunity to analyze user-generated content. The study used neural networks and deep learning to recognize mental illness-related posts on Reddit and classify them into 11 disorder themes with an accuracy of 91.08%. This could aid in content curation and targeted interventions.[17]

To predict the prevalence of PTSD and depression in individuals who are using Twitter, Reece et al (2017) have developed computational models. In this study, we collected data from two hundred and four individuals, containing one hundred and five patients with depression and ninety-nine healthy individuals. The study involved obtaining predictive features related to mood, semantics, and perspective from tweets of research participants (totaling 279,951) and using directed learning algorithms to build models using these features. The results were successfully able to differentiate depressed content from healthy ones. and performed favourably compared to the average accomplishment rates of the medical practitioner in detecting depression, although in a changed sample[18].

In a similar study, they used state-space temporal analysis and suggested that data from Twitter can be used to identify the beginning of depression some months earlier than the diagnosis. They replicated the predictive results of their previous study using a distinct sample of one hundred and seventy-four individuals diagnosed with PTSD with the help of their 243,775 tweets by using the state-space time series model. Results indicated many symptoms of PTSD can be seen after trauma, frequently several months before medical diagnosis. These findings indicate the possibility of a data-driven, prognostic approach for initial identification and assessment of signs of mental illness.[18]

The incidence of mental disorders has been increasing significantly, with approximately three hundred million people universally suffering from depression. Research shows that individuals with fewer mental health difficulties usually experience higher life satisfaction. The abundance of data created on social networking platforms provides a prospect to identify concealed patterns and increase new insights. Wongkoblap, Vadillo, and Curcin, aim to examine the relationship between life satisfaction and depression among social network handlers, spending time on Facebook for example, and develop a multilevel predictive model to classify users with depression. The research involved training predictive models on data from my Personality project, which included 2,085 participants. Two assessment tools were administered life satisfaction scale and a depression scale. The multilevel model that was developed recognized an inverse correlation between life satisfaction and depression, and it again evidenced-based research that the predictive model is helpful in the early detection of signs and symptoms of diseases.[19]

Wongkoblap, Vadillo, and Curcin, aimed to create a predictive model that can swiftly identify Twitter handlers who have depression and highlight their posts associated with mental health subjects. The model also seeks to refer to the issue of anaphoric resolution and emphasize its analyses. A dataset was collected from Twitter, consisting of 3682 users' tweets, with 1983 users stating that they are suffering from depression whereas as1699 affirming that they are not suffering from depression. Two multiple instances of learning models were created - one with an anaphoric resolution encoder and one without - to recognize operators with depression and emphasize their mental health-related posts. The model's performance was evaluated to several other published models. The results show that our anaphoric resolution model has the utmost precision, F1 score, and under the curve area of 92%, 92%, and 90%, respectively, outperforming other predictive models, including classical and deep learning models. This research shows promising results and provides valuable insights into mental health-related content on Twitter.[20]

The increasing prevalence of mental illness is causing significant problems in health and social care, efficiency, and quality of life. Although electronic health records are useful in studying mental health conditions, they do not capture patients' experiences and only reflect professional

opinions at the time of assessment. Platforms link with social media offer an opportunity to understand people's daily experiences and exchange topics related to mental health. Gkotsis et al aimed to classify Reddit posts linked to poor mental health into 11 disorder topics using deep learning and neural network classifiers. The study achieved a high accuracy of 91.08% in identifying mental illness-related posts and 71.37% in correctly classifying the theme. These results are a significant step in developing methods to manage substantial amounts of content that were generated by users and provide targeted interventions.[17]

Depression is a prominent contributor to mental illness, and it has been linked to an increased risk of premature death, as well as suicidal thoughts, and significant disruptions in daily functioning. Emotion artificial intelligence is a rapidly evolving field of research focused on detecting emotions, particularly through text analysis. With the rise of internet-based media sources, there is a wealth of user-generated data available for sentiment analysis of both text and images. Deshpande and Rao employ natural language processing techniques to analyze Twitter feeds and identify emotions related to depression. By utilizing a curated wordlist to detect depression tendencies, individual tweets are graded as negative or neutral with the help of a support vector machine and Naive-Bayes classifiers for class prediction. The study's findings are presented using accuracy, F1-score, and confusion matrix.[21]

Ethical Issues and Use of AI: It should be very clear that AI is not a substitute for human interaction in mental health care. While AI can provide valuable support and resources, it cannot replace the empathetic, personal care that mental health professionals provide. For patients' best care, there should be a harmonious use of AI and therapist in person while providing psychological help. The use of AI in mental health care offers many benefits, including remote therapy, personalized care, speedy recognition and restraint of mental health disorders, and improved quality of care. While AI is not a replacement for human interaction, it can provide valuable support and resources that can help to bridge the gap in access to care and increase treatment effects. The use of AI in mental health care represents a promising future for the field, and mental health professionals need to embrace these technologies to provide the best possible care to their clients.

Many ethical issues must be taken into consideration while using AI in mental health services, e.g., transparency and safety of data, consent to use online data, fairness of algorithms, and freedom from biases. Esmaeilzadeh, proposes recommendations on how to reasonably decrease the worries detected and sheds light on factors involving perceived threats. We believe that regulatory agencies, in collaboration with healthcare organizations, should determine standardizing guidelines and assessment strategies for the functioning and AI use in healthcare. Additionally, repeated examinations, continuing supervising, and recording systems can be used to constantly evaluate the transparency, protection, excellence, and ethical considerations of services provided by AI. These findings have implications for both research and practice around AI-based clinical decision support.[22].

The findings of this systematic review demonstrate the capability of AI to develop mental health services by providing more efficient and accessible solutions for diagnosis, treatment, and support. AI-based interventions have shown promising outcomes in the early recognition and prevention of mental health problems and the provision of personalized treatment recommendations. However, ethical considerations must be considered in the execution of AI in mental health provisions. Solitude, precision, and accountability issues need to be attended to safeguard the ethical value of AI in mental health services.[23]

LIMITATIONS
The limitations of this systematic review include the possibility of publication bias and the limited number of articles included. Additionally, the quality of the evidence was variable, and there were differences in the study designs and populations across the selected articles.

Future Directions for Research: As AI continues to advance, there are several future directions for researchers in the AI use for mental health facilities. Some potential areas of research include: Development and implementation of AI-based interventions: While there have been some promising outcomes with AI-based interventions, additional research ought to weigh the success of these interventions in the long term. Researchers can explore the use of AI in various aspects of mental health services, including screening, assessment, and treatment.

Ethical considerations: As AI becomes more prevalent in mental health services, ethical considerations need to be considered. Researchers can explore ways to adopt transparency, privacy, and responsibility concerns to safeguard the ethical use of AI in mental health services.

Integration with other technologies: AI can be used in combination with other technologies to enhance mental health services. For example, researchers can explore the use of AI in conjunction with teletherapy or mobile applications to provide more personalized and accessible mental health services.

Use of natural language processing (NLP): In NLP focuses is the interaction between human and computer languages. Researchers can explore the use of NLP in mental health services to improve the accuracy of diagnosis and the effectiveness of treatment.

Development of AI-based decision support systems: AI can be used to develop decision support systems that provide clinicians with recommendations for treatment based on a patient's unique needs and characteristics. Researchers can explore the development and implementation of such systems in mental health services.

Overall, there is much capability for AI to improve mental health services. However, researchers need to continue to explore the ethical implications of AI in mental health services.

CONCLUSION

To sum up, artificial intelligence has the potential to enhance the efficiency and accessibility of mental health services. AI-based interventions have promising outcomes for improving the identification and therapy of mental health-related issues. However, ethical considerations must be adopted to safeguard the ethical value of AI in mental health services. Privacy, transparency, and accountability concerns need to be considered in the application of AI in mental health services. Further evidence-based research is required to examine the long-term efficacy and ethical consequences of AI-based interventions in mental health assistance.

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