International Journal on Science and Technology (IJSAT)
E-ISSN: 2229-7677 ● Website: www.ijsat.org ● Email: editor@ijsat.org

AI Enabled Solutions for Mental Health Care and Support

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ABSTRACT

Chatbots are an emerging technology that shows potential for mental health care apps to enable effective and practical evidence-based therapies. As this technology is still relatively new, little is known about recently developed apps and their characteristics and effectiveness.

The integration of Artificial Intelligence (Ai) into mental health care presents transformative opportunities for improving diagnosis, treatment, and access to support. This paper explores the current landscape of AI-enables solutions in Mental Health, focusing on the capabilities, applications, and ethical considerations of technologies such as chatbots, machine learning, natural language processing, and deep learning. AI tools are increasingly used to detect early signs of psychiatric disorders, personalize therapeutic interventions, and support report care delivery, thereby bridging critical gaps in traditional mental health systems. Through a review of recent academic literature, clinical studies, and theoretical frameworks –including the technology Acceptance Model (TAM) , the Biopsychosoical Model and Human-centered AI (HCAI) – the paper examines how AI can enhance engagement, reduce stigma, and deliver cost-effective alternatives to conventional therapy. However, challenges persist, including concerns over algorithmic bias, data privacy, cultural sensitivity, and the lack of human empathy in AI interaction. This paper emphasizes the need for ethically responsible and context-aware AI implementations, guided by interdisciplinary collaboration and continuous evaluation. The study concludes that while AI cannot replace human clinicians, it holds significant potential to augment mental health care and improve outcomes when designed and deployed thoughtfully.

INTRODUCTION

Mental Health disorder, including depression, anxiety, and bipolar disorder affect over 970 million people worldwide. Traditional mental health care systems are often constrained by limited resources.

An estimated 1 in 8 person worldwide is predicted to have a mental health disorder in 2025, which represent a sizeable share of the population. This indicate that almost a billion people struggle with mental health using which can have serious negative influence on their relationship, well-being, ability to make a living. Among the most common anxiety and depression illness impact a significant number of populations.

Under the condition, Information Technology tools were used as the answer to long-standing Problems like social stigma, anxiety, a mismatch between supply and demand in the delivery of mental health care. Compared to the traditional paradigm of the mental health care, AI enabled technologies are expected to provide more accessible, reasonable prized and possibly less stigmatizing ways.

The advent of AI has changed every aspect of human society. AI, artificial intelligence is a technology that enable computer and machine to perform task that typically require human intelligence, such as learning, problem solving, decision making.

Machine learning is a subset of AI that employs statistical methods and algorithm to learn feature known as representation from large data set for pattern recognition. The most widely used classes of al in healthcare are supervised learning, unsupervised learning and deep learning.AI has several uses in health care primarily through machine learning. In order to effectively anticipate the labels on a previously unknown data set, supervised learning algorithm discover a relationship between aspects of a labeled input data set.

Unsupervised learning algorithm, work by analyzing unlabelled data to discover hidden patterns and structures without explicit instructions. They indentify similarities and differences with the data to group it or to reduce it dimensionality, ultimately providing insights into data underlying structure. Deep learning algorithm, especially deep neural network work by mimicking the structure and functions of human brain. These networks are made up of interconnected nodes or neurons arranged in layer. The information is processed by each layer before being passed onto next. Through a process known as back propagation, the network importance, its algorithm and increased accuracy by learning to make prediction by modifying the weights-the-connection between the nodes is based on the training data.

Natural language processing helps computer communicate with humans in their own language and scale other language related tasks. According, to market the global NLP market in healthcare will expand from $2.7 billion in 2023 to a projected from $11.8 billion by 2028. This growth trend is anticipated skyrocket as an increasing number of medical organizations adopt NLP for healthcare management Result in development in NLP. DL has enabled AI systems to detect emotional cures, predict mental health risks, and simulate therapeutic conversations. This paper investigates AI's capability in mental health care and provides a detailed review of its application, limitation, and potential for future integration into mainstream healthcare.

Impact of AI in Mental Health Care

AI Significantly affects mental health care through increasing accessibility, supported individualized treatment. Additionally it supports therapists; improve patient involvement, with ultimate goal of improving the effectiveness and equality of mental health treatment. However, it is necessary to address ethical issue as well as potential including algorithm bias and privacy problem.

Ai powered tools like Chabot and virtual assistant, can provide mental health support remotely and on-demand, overcoming geographical barriers and improving accessing to care. AI based mental health care applications lesson the finical and practical strains of in-person treatment by providing easy and reasoning precede substitutes for conventional therapy. Ai algorithm can process patient data, including electronic

health records, neuro imagining, and genomic data to tailor treatment plan to individual needs and preferences. This can lead to more effective and target intervention, maximizing treatment outcome.

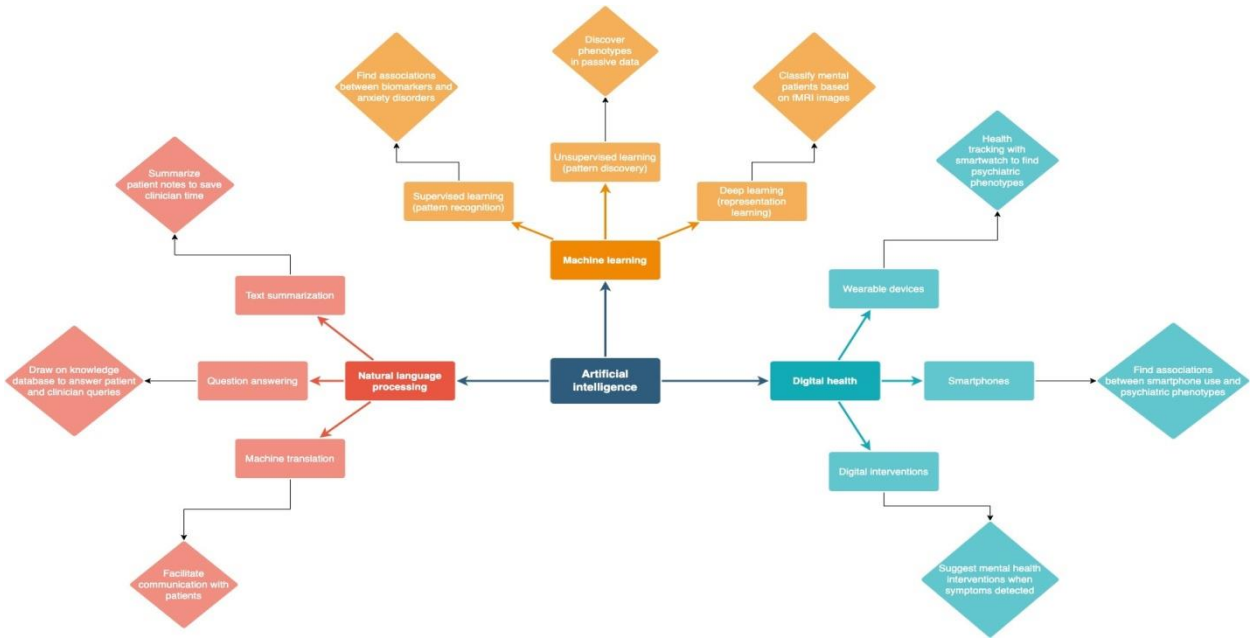

Figure1.AI technology and their potential application in mental health care.

LITERATURE REVIEW

INTRODUCTION

AI is used in mental health care diagnostics in several ways including analyzing data like speech, text, facial-expressions to identify early signs of disorders, analyzing large dataset to detect bromides associated with mental healthcare. In Recent years, AI Chatbot has become valuable tool in mental health care. It provide immediate support but also bridging the gap between patients and mental health professionals. AI Chatbot has both prons and cons .Mental health care can be costly, particularly when seeking sessions with the top professionals like the best therapist in India. Ai Chatbot offer a cost effective alternative by providing support with the high cost associate with traditional therapy. They can deliver general mental health support at fraction of cost. Machine learning model have been used to predict suicide Risk by analyzing health records, social media data and mobile phone usage

NLP:-AI is capable of delivering insights from spoken or written language. Sentiment analysis, for instance can spect emotional slot in diaries or messages on social media.

Voice Analysis: - AI is able to identify change in speech pattern (pitch, tone and rhythm) that may be signs of depression, anxiety or other illness.

Facial Expression Analysis:-AI is able to evaluate emotional state and may be spot early warning indication of mental health problem by analyzing facial expression. Several researchers have contributed to field of AI in mental health diagnostics. Early studies, often focused on using AI to analyze pattern in

clinical data, include researchers Like Dr.kevin, Dr.qiwel, Dr.yang Xie as well as Dr.Ghanghua Xio who have contributed to our understanding of how ai can be used in mental health care.

Review of Previous Studies

The ethical conundrums raised by AI in Mental Health Care are fundamentally explained by numerous recent works. Notably Researchers at Dartmouth College have conducted a clinical trial with a generative AI chatbot called "Therabot". The study enrolled 210 participants with symptoms of major depressive disorder (MDD), generalized anxiety disorder (GAD), clinically high-risk, feeding and eating disorder. Therabot and researchers evaluated participant's symptoms at a baseline, at conclusion of study of 4 weeks, at follow up week (8 weeks).

[1]Among the numerous chatbots being used in different aspects of health and well-being, chatbots in mobile MH care have demonstrated effectiveness in traditional therapy in cost effect effective and convient manner. According to this research , they found that Chatbots in mobile MH apps are presented in such a way that they have distinct personalities rather than being shown as something artificial to make users feel like they are interacting with someone emotionally and empathetic. Users describe this chatbot as having friendly, wonderfully upbeat, and mildy humorous personality that assist them in dealing with different emotional challenges.

Melanie and associates [2] .Identified that all 3 models (Gemini, chatgpt and copilot) completed with the questionnaire and generated responses aligned with LA dose calculation principles. According to their discourse analysis, all these three models currently lack the accuracy and reliability needed for safe LA dose calculation and their poor performance suggest that they should not be used as decision-making tool for this purpose, Until more reliable AI-driven solutions are developed and validated, clinicians should rely on their expertise , and careful assessment of individual patient factors to guide LA dosing and ensure patient safety.

A study by kloppel et al.[3] showed that Support Vector Machine [SVM] can use MRI scans to efficiently differentiate between individuals with Alzheimer's and those with front temporal lobar degeneration. Furthermore, they also helped distinguish between healthy individuals and those with Alzheimer's. 3D neural network architecture have also been used for the detection of Alzheimer's. in the past.

A Korean team sought to identify patients at risk of suicide amount those who expressed suicide ideation in a self admitted questionnaire, by analyzing retrospections data from natural database. This team reported good overall performance, with an accuracy of 88.9% and an AUC of 0.947.

Theoretical Framework

The development and implementation of AI-enabled solutions in mental health care are grounded in several theoretical frameworks that guide their design, adoption, and impact. This Study draws on the three major frameworks: the technology Acceptance Model (TAM), the Biopsychosocial Model, and the Human-Centered Artificial Intelligence (HCAI) framework.

1. Technology Acceptance Model (TAM)

Originally proposed by Davis (1989), the technology Acceptance Model (TAM) provides a theoretical bias for understanding user's acceptance of new technologies. It emphasizes two key factors: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), which influence user's attitudes and behavioral intentions toward using technology. In the context of mental health care, TAM helps asses how therapists, clinicians, and patients perceive AI-enabled such as diagnostics algorithm or chatbot counselors.

2. Biopsychosocial Model

The Biopsychosocial Model, introduce by Engel (1977). Offers a holistic view of health by integrating biological, psychological, and social dimension. This framework is particularly relevant in mental health care.AI system that support mental health care must be designed to reflect their complexity, incorporating data from various domains-such as electronic health records, behavioral data, and social interactions-to provide more personalized and context-aware support.

3. Human-Centered Artificial Intelligence(HCAI)

The Human-Centered AI framework emphasizes the need for AI systems to augment human capabilities while ensuring ethical design, usability and trust. It is important in sensitive areas like mental health, where users may be vulnerable and outcome can be high-stakes. HCAI principles advocate for transparency, explain ability and shared control between humans and AI system.

Limitations Identified in Existing Literature on AI in Mental Health Care

1. Lack of Personalization and Contextual Understanding

AI model may fail to capture the full complexity of human emotions, cultural nuances, and individual context. In a 2019 study by Vaidyam et al., research explored the use of conversational agents (chatbots) t improve engagement in digital mental health care. The study found that conversational agents can enhance user engagement and potentially lead to better outcomes in areas like psycho education and self-help. Specially, text-based conversational agents have been shown to increase program adherence compared to verbal presentations.

2. Ethical and privacy Concern

AI has potential to bring about significant changes and advancements in the mental health care but AI also has certain limitations in mental health care. The importance of privacy considerations related to the sensitive nature of mental health data cannot be overstated. Algorithm bias poses a potential risk since it may result in insufficient or unsuitable assistance for specific populations. Moreover, AI is devoid of human empathy and comprehension, which are vital in therapeutic interactions. Hence, although AI possesses considerable potential in mental health care, it is crucial to deliberate its limitations to ensure responsible and effective implementation.

State Of The Art: AI in Mental Health Care

Researcher	Affiliation	AI Technology Used	Research Focus / Contribution
Dr. Vikram Patel	Harvard Medical School / Sangath (India)	Not AI-specific (Uses digital health tools)	Global mental health, task-shifting, scalable psychological interventions
Dr. Thomas Insel	Former Director, NIMH	AI for early detection, digital phenotyping	Precision psychiatry, mental health tech entrepreneurship (e.g., Mindstrong Health)
Dr. Helen Christensen	Black Dog Institute, UNSW	Web-based CBT tools, basic decision-tree AI in apps	eMental health, suicide prevention, MoodGYM digital therapy
Dr. John Torous	Harvard Medical School / BIDMC	Digital phenotyping, machine learning, app-based sensing	Clinical validation of mobile apps, mindLAMP app, ethical AI in psychiatry
Dr. Emily Holmes	Uppsala University	Game-based interventions (no direct AI, but tech-assisted)	Trauma therapy, memory disruption techniques for PTSD
Dr. Ian Hickie	Brain and Mind Centre, University of Sydney	Predictive analytics, machine learning	Youth mental health, mental health system reform
Dr. Robert D. Keeley	University of Colorado	NLP for clinical documentation and screening	Primary care integration, depression screening in general practice
Dr. Munmun De Choudhury	Georgia Institute of Technology	NLP, deep learning, social media mining	Predicting depression/suicide using Twitter, Reddit, digital behavior analysis
Dr. Andrew T. Campbell	Dartmouth College	Mobile sensing, context-aware AI, machine learning	StudentLife app – predicting stress, depression using smartphone sensor data
Dr. Rosalind Picard	MIT Media Lab / Affective	Affective computing, emotion recognition, machine learning	Wearable emotion-sensing devices, detecting stress and mood using biosignals and facial analysis

Methodology and Data Sources

A qualitative research design based on content analysis and a comparative literature review is used in this study. The goal is to determine and analysis of existing academic literature, clinical trials, and AI applications case studies related to mental health care.

1. Analysis of Comparative Literature

A total of over 30 academic papers published between 2021 and 2024 were systematically reviewed. The selection criteria included:

·Inclusion of **empirical findings** or **policy-based insights**

·**Peer-reviewed** publication status

·Relevance to topics of **AI ethics**, **mental health applications**, and **technology integration**

Major academic database such as the ACM Digital Library, IEEE Xplore, SpringerLink, MDPI, and arXvi were utilized to ensure diversity and academic rigor in the source material

2. Application of Theoretical Frameworks

To explore user trust acceptance, and the ethical implications of AI in the mental health care, this study integrates the following frameworks.

Technology Acceptance Model (TAM) – to understand user attitudes, perceived usefulness, and ease of AI tool adoption.

Framing Theory – to examine how AI technologies are presented in media and clinical settings, shaping public and professional perceptions.

Ethical Constructs – to assess the **normative justifiability** of AI-generated content and decisions, particularly in sensitive mental health contexts.

3. Consideration of Emerging Academic Reliability and Ethical Issues

Academic Integrity: Chavez et al. (2024) documented a rise in AI-assisted plagiarism, particularly in ICT and language departments, highlighting growing concerns among educators.

Disinformation through Deep fakes: Patterson (2024) investigated the proliferation of AI-generated deep fakes during political election seasons (2022–2024), reporting an **80% increase** in AI-driven disinformation across social media platforms.

Continuous discussions are needed to comprehensively understand responsible AI use in healthcare. There are two primary future potentials on responsible AI in healthcare. First, we need to understand the individual, organizational, and societal impediments to achieving the SHIFT of AI. Previous medical AI research focuses on the technological understanding of its implementation and exploring the economic value of AI applications. Future research is needed to understand the practices, mechanisms, and ecosystems that facilitate responsible AI use in healthcare. Second, while the tools that leverage AI are valuable for improving clinical practices, their actual use by healthcare professionals is not without challenges. To address the challenges associated with the use of AI, AI solution providers and developers should aim at designing and implementing ethical, transparent, and accountable AI solutions. This ethical consideration of AI would help healthcare organizations maintain trust and minimize potential risks. Thus,

future research is needed to understand the role of responsible AI use from the SHIFT perspective to create value and reduce potential risks in healthcare.

Result

The comparative analysis of over 30 academic papers from 2021–2024 revealed increasing scholarly concern about the ethical implications of AI in mental health care. Key themes identified include academic dishonesty through AI-assisted plagiarism (Chavez et al., 2024), and the rapid spread of political misinformation via deep fakes during elections (Patterson, 2024). Applying the SHIFT framework, the literature emphasized the significance of stakeholder inclusion, fairness, and transparency in AI design. Furthermore, TAM and Framing Theory analyses highlighted a gap between technological potential and user trust, underscoring the need for human-centered, accountable AI implementation in healthcare systems.

Despite these limitations, this review underscores the complementary relationship between AI and healthcare by describing how the two fields help each other to promote positive mental health and places emphasis on the pivotal role of collaborative efforts between diverse experts in driving the responsible integration of AI into mental healthcare.

In this evolving landscape, it is also crucial to balance the immense potential of artificial intelligence with ethical responsibilities. We must consistently assess and refine its use to ensure it aids human abilities rather than replacing them.

The future of AI in mental healthcare is indeed promising. Researchers and practitioners that are vested in improving mental healthcare must take an active role in informing the introduction of AI into clinical care by lending their clinical expertise and collaborating with data and computational scientists, as well as other experts, to help transform mental health practice and improve overall care for patients.

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