

1.2 The Role of AI in Modern Psychiatry

AI is contributing positively to Psychiatry by improving diagnostic accuracy, predicting changes in disease state, and adjusting medication accordingly. By analysing data from medical records, imaging results, and patterns in speech or behaviour, machine learning techniques identify early symptoms of mental illnesses.[4]. They leverage AI to develop real-time mental health support through tools like chatbots and mobile apps, as well as predictive models, to assist clinicians in designing specific intervention plans. Healthcare establishments will benefit from improved early detection and integrative mental health services enabled by AI in psychiatric care, leading to better treatment plans that are more accessible and efficient [7] [19] [12].

1.2 Objectives and Scope of the Chapter

This chapter shall investigate the overlap between AI and psychiatry, with a focus on how technological innovations enhance the detection, remediation, and management of Severe Mental Illness. This section aims to achieve the following objectives:

- Discussion of the challenges associated with the assessment and management of SMIs
- Exploring the focus of Psychiatry concerning the use of AI in building care pathways
- Ethics and limitations of the use of AI in psychiatry
- Opportunities and future directions for AI-based psychiatry

2. UNDERSTANDING SEVERE MENTAL ILLNESSES (SMIS)

2.1 Definition and Classification of SMIs

Severe Mental Illnesses (SMIs) are those mental illnesses that result in a considerable deterioration of an individual's cognition, emotions, and sociability [6]. Typically, SMIs are considered a form of chronic illness that requires high-level medical treatment, thereby affecting a patient's quality of life [13] [15][140].

- There are two classifications of SMIs in terms of their severity, chronicity, and degree of functional incapacity experienced by the patient. These include the following:
- Schizophrenia Spectrum Disorders: Manifestations of hallucinations, delusions, and cognitive deficiencies.
- Bipolar Disorders – Emotional instability in the form of manic and depressive moods.
- **Major Depressive Disorder (MDD)** — chronic severe depressive cycles that substantially disable
- **OCD (Severe Cases)** — For when their symptoms are severely disruptive of everyday life.
- **Severe Anxiety Disorders** (Panic Disorder, PTSD, etc.) — Chronic and exhausting anxiety [115].

2.2 Challenges in Diagnosis and Treatment

Diagnosing and treating SMIs is complex due to several factors:

- **Subjective Diagnosis:** While other diseases have biomarkers, SMIs are not definitively diagnosed using an 'objective' measure and rely on clinical interviews with symptoms based on patient reports [3].
- **Delayed Diagnosis:** This condition usually emerges slowly, so symptoms are not detected early, and the condition is at an advanced stage before they intervene.
- **Dysmorphic Traits:** The same disorder may present differently for individuals, which makes generalising treatment monotherapy more difficult.
- **TMS Treatment Resistance:** Most patients are unresponsive to conventional psychiatric medicines, therefore having to resort to alternative or combination therapies [159] [120].
- **Stigma and Accessibility:** The main problem is that stigma stops access to mental health treatment, and need-oriented psychiatric care is not always easily available in certain areas [22] [123] [126].

- **Managing and Preventing Relapses:** You require long-term treatment to avoid relapse, but the follow-up of these patients is impossible in resource-poor settings.

2.3 The Need for Technological Interventions

Due to these challenges, the potential of using Artificial Intelligence (AI) in psychiatry is expected to transform the entire field positively in terms of improved early detection, personalisation of treatment, continuous monitoring, and increased accessibility [4]. By using AI, the system will be able to analyse the patient's verbal and non-verbal speech patterns, facial expressions, and other behaviour characteristics for the detection of early symptoms of very serious mental disorders (SMIs) where intervention is needed urgently [128]. Machine learning algorithms can also be used in identifying the appropriate therapeutic interventions for specific patients through analysing the patients' medical records and recommending personalised solutions. The use of wearable devices and smartphone applications makes it easy to capture mood variations and behavioural changes of patients at all times [149]. AI-based telepsychiatry tools that incorporate AI technologies can address this challenge and offer high-quality services in remote locations that lack sufficient healthcare professionals. Furthermore, AI-based chatbots and virtual therapists can offer some degree of help in dealing with mental disorders in order to reduce the associated stigma and encourage individuals to seek medical assistance without being ashamed [134][14].

3. ARTIFICIAL INTELLIGENCE IN MENTAL HEALTH CARE

The use of artificial intelligence (AI) is impacting how SMIs are diagnosed and managed. The use of AI can help in diagnosis and predict the progress of the diseases and provide personal treatment plans for patients, among other uses of AI. This is how the AI technology can be used in psychiatry:

3.1 AI-Powered Diagnostic Tools

Artificial intelligence (AI) is revolutionising not only the diagnosis of severe mental illnesses (SMI) but also their treatment. Diagnosis through AI, prediction of progression before disease onset, and personalised treatment methods are some of the key methods that have been adopted by the AI tools. The following are some of the major AI tools being used in psychiatry [127].

3.2 AI-Powered Diagnostic Tools

Apart from others, one of the major issues in psychiatry is the subjectivity of the diagnosis process because it does not have biological markers and mostly depends on the symptoms observed in patients [4].

The problem can be solved using AI diagnostic solutions using data-driven techniques.

- **Neuroimaging Analysis:** AI can read MRI and fMRI scans to discern brain differences that are consistent with psychiatric diseases, i.e. schizophrenia, bipolar disorders, etc. [13].
- **Speech and Voice analysis:** AI models interpret tone of voice, pitch and speech patterns to detect the primary signs of depression, psychosis and anxiety disorders in advance [51].
- **Face Detection & Behavioural Interpretation: machine learning algorithms interpret micro-expressions, eye-tracking and other facial signals to gauge emotional discomfort and alert signs of mental illnesses in the early stages.**
- **Digital Phenotyping:** Smartphone apps use AI to collect behavioural data passively (typing speed, sleep patterns, social interactions) and examine changes related to SMIs in behaviour [154][133][156].

3.3 Machine Learning for Predictive Analysis

Machine learning algorithms can read through massive datasets to predict the onset and trajectory, as well as response to treatments of mental illnesses, allowing for much earlier intervention and precision medicine. AI: AI model processes historical patient data (person level) to determine which patients have a high risk of progressing towards serious mental

illnesses (SMIs) in behavioural, genetic, or environmental factors [62][144][122]. Predictive analytics also enables clinicians to step in before things get too bad through anticipating relapse patterns. The artificial intelligence learns from the success rate of the therapy in many patients to suggest the use of medications and treatments for optimal results. This will reduce the chances of guesswork in the process of diagnosis and improve the patients' life span [42] [49]. In addition, suicide prevention through AI also monitors the social networking sites and behaviour reported on electronic health records to detect any signs that will assist health practitioners to make interventions. The above examples are just scratching the surface of possibilities with respect to how AI can transform mental health care through the use of information [55][130].

3.4 Natural Language Processing in Psychiatry

Natural Language Processing (NLP) revolutionises psychiatry thanks to the capacity of the AI system to comprehend, analyse, and act upon human language in terms of assessment and treatment.

- Automated psychological assessments: NLP-enabled chatbots/virtual therapists have been used to interact with patients' clients in order to conduct an examination of the patient's mental state and also offer some immediate therapy
- Sentiment and emotion detection: These algorithms detect changes in the patient's mood and other emotional states through analysis of the language input data.
- Clinical document extraction & decision support systems: NLP technology helps clinicians reduce their workloads regarding documentation and extract relevant information from psychiatric reports.
- Chatbots for therapy: AI chatbots such as Woebot and Wysa help patients practice CBT skills and offer emotional support on mental wellness [71][123].

4. AI APPLICATIONS IN TREATING SEVERE MENTAL ILLNESSES

Artificial Intelligence (AI) is dramatically transforming the care of Severe Mental Illnesses (SMI) provision through tailored interventions, enhancing treatment engagement, and allowing for enduring patient surveillance [116]. Using machine learning, natural language processing, and a blend of predictive analytics, AI is improving the use of conditions including schizophrenia, bipolar disorder, MDD, PTSD and other severe anxiety disorders [81]. With the depth of AI applications in treating these conditions, details are below

4.1 AI in Schizophrenia Treatment

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4.2 AI in Schizophrenia Treatment

Schizophrenia is a neuropsychiatric disorder with symptoms of hallucinations, delusions and cognitive deficits, and AI has substantial potential to transform its clinical workflow and treatment. AI models examine MRI and fMRI scans, as well as genetic data, to identify very early aberrations of the brain associated with schizophrenia, which would permit timely intervention and subsequent management of the disease's progression. By applying machine learning algorithms, they will be able to analyse not only the speech but also the body language in order to measure the severity of the symptoms and to predict psychotic attacks as a precursor to a psychotic episode [76] [82] [110]. AI-assisted Medicine: This technology will help in tuning the prescription of antipsychotics because it will help predict complications and suggest treatment plans by using genetic markers, thereby taking a step away from the trial-and-error approach in terms of medications. Moreover, virtual reality treatments in the shape of AI-based VR will give patients an immersive experience and will help them go through some real-life scenarios that can help them deal with their delusions and hallucinations [91] [112][150].

4.3 AI for Bipolar Disorder Management

In both scenarios above, bipolar disorder is characterised by severe mood swings involving episodes of mania and depression, and these episodes have to be addressed separately. AI is significant in

- **Prediction and Monitoring Cues for mood: Using apps to analyse** the tone of voice, typing habits, and physical movements that indicate the occurrence of either manic or depressive episodes.
- **Selection of Medication:** Through machine learning algorithms to observe patients' reactions to mood stabilisers, doctors can select the best drug suitable for the individual while minimising side effects.
- **Cognitive Behavioural Therapy Chatbots (CBT): These are AI that help people** in real time for upcoming mood tracker & coping mechanisms [1].
- **Sleep & Lifestyle Tailored Recommendations:** AI-based systems unravel sleep functions and physical activity data to propose modifications in lifestyle protective mood

4.3 AI in Major Depressive Disorder (MDD) Treatment

AI Sentiment Analysis: With the help of AI models analysing text and speech, therapists can check for the symptoms of depression to keep track of treatment.

- **Suicide Risk Prediction:** By analysing social media, search history and medical data, machine learning algorithms determine who is at risk for self-harm.
- **Patient-Level Recommendation for Personalised Therapy: AI: making predictions for individualised** therapeutic approaches (e.g. CBT, medication, predominant training) which are the most likely to result in success depending on the patient's data [1].
- **Teletherapy with AI:** You listen to an AI-driven mental health assistant for the virtual therapy, and at the same time, you will be able to get instant emotional soothing and coping strategies [99].

4.4 AI-Assisted Treatment for PTSD and Anxiety Disorders

Post-Traumatic Stress Disorder (PTSD) and incapacitating anxiety disorders need constant supervision with enforced measures of evidence, and this is where AI is really stepping up management, or rather, troubleshooting of these two giants with a lot of innovation [1]. AI exposure therapy makes use of the technology VR simulations to slowly expose patients to mild anxiety-provoking situations and desensitise their fear responses safely with the aid of virtual reality (VR) [87] [111]. Pervasive AI enable predictive anxiety detection, monitors physiologic signals (HRV and skin conductance, etc.) for the detection of rising anxiety levels in patients, which allows real-time coping strategy adoption. AI-powered chatbots offer fast therapeutic support by providing cognitive therapy, one-on-one with real feelings, working side-by-side with neighbours on how to perform exercises or use evidence-based interventions [158]. The impact of AI on medication management is realised by way of profound analysis of reaction to treatment and the automatic dosage adjustment for maximum effectiveness and minimum side effects on the patient's part. Not only will AI raise the level of medical services, but it will also give more time for patients through its involvement in PTSD and anxiety disorders treatment [131].

5. I-POWERED THERAPEUTIC APPROACHES

The adoption of Artificial Intelligence (AI) in mental health care has changed the landscape of healthcare by bringing in individualised, ubiquitous and data-driven care for mental illness. AI therapeutic tools increase the efficacy of treatment and increase patient engagement by delivering real-time support. This post will focus on some of the main AI therapy solutions identified to date, including chatbots and virtual talking therapies powered by AI in CBT, as well as tailored treatment options [1][12].

5.1 Chat-bots and Virtual Therapists

AI chatbots and virtual therapists, as players in bridging mental health support in real-time, are becoming the norm for accessible, stigma-free assistance, patient-facing.

- **24/7 Mental Health Buddy:** AI chatbots are available literally around the clock to offer individuals support with stress, anxiety and depressive symptoms that overshoot traditional therapy sessions.
- **Healthcare Conversational AI:** Therapists (Woebot, Wysa and Replica use natural language processing (NLP) because a conversationalist throws in empathy to reassure the user on their way to self-help techniques.
- **Recognises early signs: The AI chatbot uses information from the responses of users to recognise** any signs of distress and advises on getting help if needed [11].
- **Therapeutic Exercises and Coping Mechanisms:** they provide virtual therapy through the use of therapeutic exercises and breathing techniques specific to each one [59].

5.2 AI in Cognitive Behavioural Therapy (CBT)

Cognitive Behavioural Therapy is one of the common methods used in psychotherapy that allows people to recognise and modify maladaptive thought processes. AI is changing the face of the ways CBT can be applied through technological innovations [91].

- **Automated CBT Sessions:** The AI software is capable of automating the CBT session with algorithm analysis of the thinking distortions, differences in categorisations, and cognitive composition.
- **Quick feedback and progress tracking:** AI will monitor what is being typed and provide feedback for emotional levels and behaviour changes necessary for effective CBT interventions.
- **Speech & Sentiment Analysis:** Through the use of AI, it becomes easy to analyse the voice tone, body language, and writing styles used to determine emotional states and apply CBT techniques.
- **Self-Help CBT Programs:** The AI devices provide self-help CBT sessions that are useful for those who may choose not to seek professional help.

5.3 Personalised Treatment Plans Using AI

Psychiatric approaches tend to be generalised rather than customised according to the person's specific needs. The future of mental care has been predicted as one that will see the utilisation of AI to develop customised therapy for every patient based on their unique information to increase efficacy. This is accomplished by applying predictive analytics based on machine learning to two models to predict the most effective therapy approach for each individual patient [122]. Second, AI allows for near real-time treatment modifications by continuously tracking the progress via wearables, mobile apps, and digital assessments to dynamically rotate treatment pathways immediately. AI tries to optimise prescriptions by observing the many patient-specific factors, such as metabolism, genetics, side effects, and downstream effects, to reduce the trial-and-error process in medication management. It also processes data on lifestyle things, such as sleep schedule, physical activity and diet for body and brain wellness for comprehensive treatment recommendations. This makes mental healthcare more personalised, possibly better-suited and immensely effective thanks to the use of AI, resulting in better patient outcomes [89] [104].

6. AI IN DRUG DISCOVERY AND MEDICATION MANAGEMENT

Artificial Intelligence (AI) is changing the nature of psychiatric drug discovery and management in Severe Mental Illnesses (SMI) by driving new rapid psychiatric drug hits discovery, augmenting personalised medicine prescriptions, and improving medication adherence [6]. In the end, AI-powered solutions streamline processes, drive cost reduction, and improve the quality of treatment. AI's part in discovering novel psychiatric drugs, precision medicine for SMIs and systems of medication adherence will be discussed in this section [107] [109].

6.1 AI for Identifying New Psychiatric Drugs

Over a 13-year course, traditional drug development for psychiatric medications (A traditional way of developing new psychiatric medicines) is a lengthy and expensive undertaking. The traditional process of finding new drugs is changing...

- **Drug Target Discovery:** Genomic and biochemical data are used through the AI tool to identify potential targets for psychiatric drug treatment, like neurotransmitter imbalances (schizophrenia) or mood disorders.
- **Machine Learning Driven Drug-Target Interactions:** The machine learning models predict how a class of drugs interact with brain receptors without the need for extensive lab studies.
- **Repurposing Drug:** AI, the medication available already, to check if it could be used in your psychiatric disorder, speeds up approval
- **Minimising Side effects: Simulations of AI predict the side effects a drug can have even before it enters clinical trials,** making the psychiatric drugs safer [110].

6.2 AI in Precision Medicine for SMIs

AI is enabling precision medicine for the most serious mental disorders by personalising treatments at the genetic/environmental/lifestyle levels. Genetic and biomarker analysis allow AI to interpret genetic coordinates as well as brain images for the prediction of medication responses, leading to an even more personalised treatment. Targeted Medication AI models allow personalised drug selection to be analysed by patient background, symptom severity and previous response, leading to more potent drugs with greater off-target safety. Dynamic medication dosing is adjusted in real time by the psychiatrists who monitor patient symptoms through an AI digital health platform [2]. In addition, AI is used to enhance the co-formulation of drugs, which prescribes the best match between medications, hitting, and lifestyle shift & therapy approaches for best practice [69].

6.3 AI-Driven Medication Adherence Systems

Non-adherence to medication is a significant problem in SMI care, with high relapse rates, in-hospitalisations, and worsening symptom severity due to it. Enhancing adherence with AI-enabled solutions.

- **SMART Pill Dispensers:** At the other end of the spectrum, AI devices remind patients to take their medication and monitor adherence in real time.
- **Wearable and Mobile Surveillance:** Wearable devices that are capable of recognising the medication intake patterns and providing alerts for any missed doses via the app.
- **AI Chat Bots (Patient Engagement):** The virtual assistant keeps track of the patient and answers any questions about the medications and motivates them towards adherence.
- **Predictive Adherence Models:** Using AI, the behaviour patterns are analysed, and the high-risk patients who might not adhere are predicted through the model.

7. AI FOR REMOTE MONITORING AND EARLY INTERVENTION

Remote Monitoring and Early Intervention for Severe Mental Disorders (SMIs) through the revolutionary capabilities of Artificial Intelligence (AI). AI-enabled devices like wearable technologies and mobile apps help monitor patients around the clock, predict early relapse, and intervene promptly. It ensures easy access, fewer hospital visits, and better results at an individual level. The paper will focus on AI for wearables and mobile health technologies, periodic prediction of relapse/violence, and remote monitoring through AI.

7.1 AI in Wearable and Mobile Health Applications

Wearable devices, along with AI technology and mobile apps, are revolutionising mental health treatment: Real-time monitoring, personalised treatment, and a holistic approach to improving mental wellness.

- **AI-Driven Wearable Biosensors:** Through the use of AI-driven wearables (smartwatch/rings/fitness trackers), heart rate variability, sleep, skin temperature, and other physiological metrics can be monitored in order to detect changes associated with mental disorders.
- **AI-Driven Mobile App:** Through the use of AI-powered apps that consider users' behaviours along with social media usage and speaking patterns, it is possible to detect emotions and coping techniques. It might include cognitive-behavioural therapy or mood trackers.
- **Digital Phenotyping:** Through the use of AI-powered mobile data (such as typing speed, screen time, location using GPS), it is possible to monitor behaviours in connection with mental health disorders.
- **Immediate Feedback & Treatment Interventions:** AI-powered algorithms provide direct feedback on how to improve users' well-being by participating in mindfulness practices, therapy sessions, and medication dosage adjustments.

7.2 Predicting Relapse and Suicide Risk with AI

Predictive analysis (Yes, you heard me correctly; AI) plays an immensely crucial role in determining patients who may relapse or experience suicidal thoughts, so appropriate measures can be taken on time.

- **Relapse Prediction Models:** Predictive models using machine learning analyse patients' data, behaviour, history, as well as how they respond to different forms of treatment and use them to predict relapse rates for diseases such as schizophrenia, bipolar disorder & depression, etc.
- **Suicide Risk Assessment:** AI reads social media, electronic health records, and stream processing of speech to identify suicidal ideation warning signs. Crisis Text Line (among others) uses AI to determine which high-risk cases it should focus on by identifying patterns within language.
- **Effective Content and Sentiment Analysis:** Using AI, the emotional distress is discovered through changes in face, voice tone, and text-based communications.
- **Prospective alerts for Caregivers/Care Clinicians:** AI-enabled systems sound an alarm to healthcare providers and support networks about an impending severe distress of a patient, such that intervention can be made to avoid a crisis.

7.3 Remote Patient Monitoring and AI-Driven Alerts

Remote patient-monitoring offers a unique opportunity to transform mental health care by delivering continuous data-driven insights regarding the mental state of psychiatric patients with AI-powered remote monitoring systems. Chatbots incorporated with AI into virtual check-ins interact with patients, daily monitoring mood, sleep patterns, medication adherence, and stress. Biometric and behavioural data are analysed in real-time AI alerts that call the psychiatrist as necessary — even the EMTs. The use of telepsychiatry allows for clinical decisions through the provision of data and symptom change analysis of the patient. AI geofencing detects movement anomalies that include isolation and travel to risky areas, among others, to offer timely assistance. This implies that future mental health care will be more proactive, practical, and personalised.

8. CHALLENGES AND ETHICAL CONSIDERATIONS IN AI FOR MENTAL HEALTH

However, Artificial Intelligence (AI) can potentially bring about changes that can transform the way mental healthcare services are provided; however, there are significant challenges associated with it that have come up in the form of various ethical concerns. Privacy of data, potential bias in AI models, as well as ethical and legal concerns, have to be addressed to ensure the responsible implementation of AI in psychiatry [4].

8.1 Data Privacy and Security Concerns

Mental health data is very confidential, and any misinterpretation or misuse of the data can have grave consequences for the patients involved. There are various privacy and security challenges that need to be overcome in order to design AI-based mental health software.

- **Confidential Data of Patients:** AI-based applications contain massive amounts of data about patients, including personal data such as voice patterns and behaviour data stored digitally.
- **Security Measures and Data Storage:** Strong Encryption techniques, as well as secure cloud storage, must be in place in order to prevent cyber attacks and data theft.
- **Anonymisation and Consent:** AI systems must ensure that the data of patients is anonymised wherever necessary, and users consent to data collection.
- **Data Exploitation Risk:** AI Developers of mental health-focused AI tools need to follow strict data protection statutes (GDPR, HIPAA, etc.) to prevent the exploitation of patient information for any purpose other than exclusively medical [5].

8.2 Bias and Fairness in AI Models

Biases can be transferred to any sort of AI models in mental health care, which are trained on this skewed dataset, leading to misdiagnosis and treatment disparity. Demographic bias may make AI perform poorly for races, ethnic groups, gender, or socio-economic groups, resulting in differential misdiagnoses on account of no recognised symptom-burden variance between cultures. The algorithmic discrimination could simply be that individuals are 'acceptable' vs not (i.e. rich/well-connected white males may receive more care vs. all other patients). Incorrect assessments are provided when unrecognised differences in symptoms across cultures go undetected, and AI adds to the subset of unqualified, but at least, accountability away from a lack of cultural sensitivity. Moreover, transparency on AI is by far out as most of the models act ultimately in the guise of a "black box. We need datasets to address these problems (both types) and bias audits with truly targeted explainable AI (XAI), culture-informed development for meaningful mental health care.

8.3 Ethical and Legal Implications in Mental Health AI

The increasing adoption of the technology in mental health services calls for sophisticated and complex issues that should be addressed, regarding ethics and legal matters.

- **Patient Informed Consent and Patient's Autonomy:** Patients must be fully informed about how AI-based technologies work, what the technologies are used for, and how patients participate in AI-enabled mental health services.
- **AI as a Means, not an End of Diagnosis and Treatment** of a Psychiatric Disorder: It means that AI must assist the human physician in their diagnosis and treatment process. This can raise the question of error in the process, probably due to excessive reliance on the machine.
- **Liable Party in Case of Error: Liability** for errors or failures to provide proper prediction and prevention of suicidal tendencies of the patients may be unclear; whether it is the developer of the software, the physician, or the hospital itself [119].
- **Regulation and Compliance of Medical Standards:** For AI-based psychiatric tools to ensure accuracy and reliability, strict adherence to medical standards should be guaranteed [110].
- **Excessive Surveillance via AI-Based Systems:** For example, the use of geotagging and likes in social networks can raise privacy rights violation issues [138].

9. FUTURE DIRECTIONS AND INNOVATIONS IN AI FOR SEVERE MENTAL ILLNESSES (SMIS)

The future implications of Artificial Intelligence in Mental Health care have huge potential to cause massive changes; there is a promise of radical improvements in diagnostics, therapy, and patient management in severe mental illnesses (SMIs) [6]. Developments in AI that include Explainable AI (XAI), the use of AI with neuromodulation treatments, and existing research projects are predicted to bring about a revolution in psychiatric practice. We shall explore here the frontier areas of AI-based mental healthcare interventions.

9.1 The Role of Explainable AI (XAI) in Psychiatry

A major limitation in AI for mental healthcare is that most AI decisions are not transparent and can lead to mistrust, preventing AI from being adopted horizontally (one step below the mainstream). Explainable AI (XAI) comes in to solve this challenge by enabling interpretable and transparent AI models that expose the reasoning behind an AI-driven decision so that mental health professionals and patients can understand in plain English. A clear diagnosis of AI supports clinicians in interpreting the reasoning behind the automatic diagnoses, enabling clinicians to have more confidence in the care provided by AI in psychiatric treatment. Moreover, XAI aids in reducing bias detection with the interpretable AI recommendations to facilitate effective communication between the patients and their psychiatrist for better treatment plan adherence. One of the most valuable XAI is detecting and removing bias in psychiatric AI systems to provide accurate diagnosis, giving theoretically fair treatment across diverse populations. Explainability with AI-driven psychiatric care also lends itself to ethical and regulatory compliance, as it would help ensure responsible AI deployment within Mental Health for mental health applications (one step up from responsible use), and a store of medical/legally acceptable AI-based practices. To make AI-powered solutions more transparent, ethical, and maybe even acceptable, mental health treatments could become even better with XAI in Healthcare [6].

9.2 AI and the Integration of Neuromodulation Therapies

Neuromodulator therapies (e.g. Transcranial Magnetic Stimulation, TMS, Deep Brain Stimulation, DBS) are becoming more and more efficacious in treating SMIs. How these therapies will be optimised and personalised through AI integration.

- **AI TMS, DBS:** AI algorithms can evaluate the brain imaging for patients to enable treatment-tailored stimulation and efficacy in individual patients
- **Response Models to Modelling the Prognosticate:** Use of machine learning algorithms to predict patient responses to neuromodulation facilitates personalised dose adjustments.
- **In-the-Loop Adaptive Neuromodulation: Real-time closed-loop AI-driven systems can monitor Brainwave activity and adjust levels of stimulation online for the best therapeutic result.**
- **Real-time AI-driven neuromodulation (Non-Invasive): AI-based** tools have been developed for improving neuromodulation without surgery.

9.3 Future Research and Development in AI for Mental Health

Over the next decade, we will see substantial progress in mental health as AI-disrupted solutions take us to better, more personalised, and accessible care. An area of interest indeed has been the creation of multimodal AI systems which use data from speech, facial expression, brain imaging and wearable sensors to yield whole mental health diagnostics that will probably be improved. As per Figure 2 and Table 1

Table 1. AI Advancements in Mental Health

AI Advancements in Mental Health	
AI Advancements	Impact Level (1-10)
Multimodal AI Systems	9

AI-powered VR Therapy	8
Personalised Digital Therapeutics	9
AI in Psychopharmacology	7
Ethical AI Frameworks	10

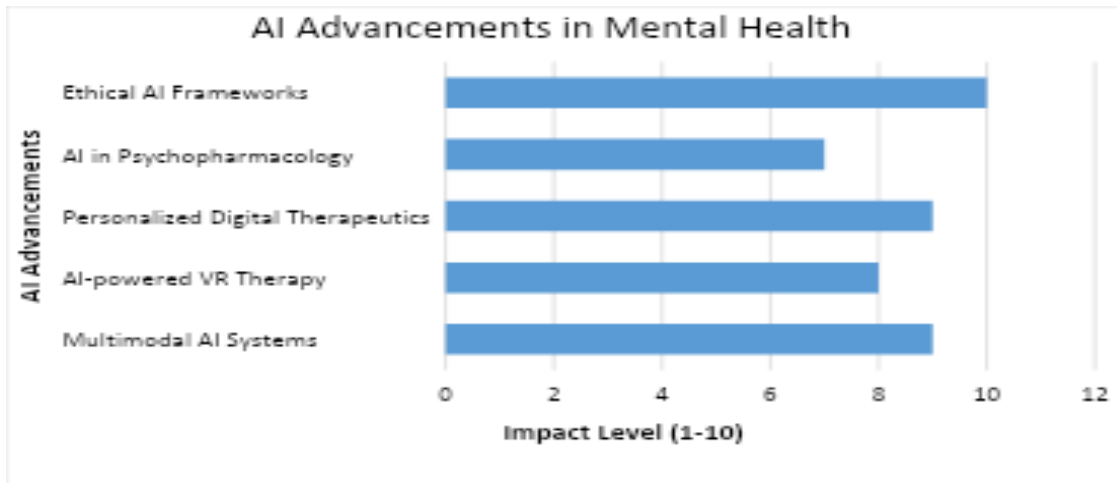


Fig.2. AI Advancements in Mental Health

Another way AI will be integrated into virtual reality (VR) therapy is likely to improve: bringing users worlds they can practice exposure or social skills in, especially useful for psychiatric disorders, a-posterior PTSD, schizophrenia and so forth) [1]. Moreover, personalised digital therapeutics will implement AI-powered solutions to deliver on-demand adaptive mental health interventions that fit the needs of every individual. AI Systems will factor into psychopharmacology- the way forward for new psychiatric medications leverages AI to develop more effective drugs with fewer side effects [6].

10. Conclusion:

Artificial Intelligence solution in mental health: Improving psychiatric care with new AI-powered capabilities to attain the diagnosis, treatment, and management of Severe Mental Illnesses (SMI). The development of AI inference tools, such as neuroimaging analysis, speech recognition, and digital phenotyping, will improve early recognition and accuracy driven by diagnostics. Predictions of disease progress, treatment tailoring and medication management with machine learning models - to avoid experimenting with dirt-cheap, mistaken ways in psychiatry, with a potential move away from empiricism. AI-enabled AI Therapeutic paradigms (chatbots, virtual therapists) and AI-CBT apps provide 24/7 mental health support, AI-powered Cognitive behavioural therapy (CBT) tailored interventions. The natural evolution of technology in remote monitoring, wearable devices, and mobile health apps to measure live patient behaviour metrics in real time, aiding clinicians in predicting relapse & suicide risk so they can act in a timely manner. Although all these advances have been achieved, below are some of the limitations of using AI in medical applications: the need for fairness in AI model use, the need for transparency through XAI, and the need for compliance are ways to achieve ethical AI implementation.

Potential future directions for AI in mental health (and beyond) could involve combining AI with neuromodulation therapies, including TMS and DBS, to achieve greater accuracy in diagnosis and treatment, or AI-enhanced VR therapy with multimodal AI digital therapeutics. The evolution of AI in psychiatry will take many years, and this may revolutionise current treatments through greater access, efficiency, and personalisation for SMH patients.

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