**Exploring the potential of artificial intelligence (AI) as a tool for the treatment and management of depression**

**Dr. Shashi Verma**

**Associate Professor, SRMSCET Pharmacy, Bareilly**

**ABSTRACT**

Since depression's etiology is unknown and it is associated with high rates of morbidity and death, treating and managing it remains one of the most important problems that doctors face today. Its management and treatment can be thought of as taking a two-pronged approach because numerous psychological therapies (such as behavioural therapy, cognitive therapy, interpersonal therapy, etc.) as well as medication-based therapy play a significant part in its successful management and treatment. The use of artificial intelligence (AI) as a mental health therapist for the management and treatment of depression can be a substantial and effective strategy, in addition to the many other applications of AI in the healthcare system. Virtual or robotic therapists that use artificial intelligence to respond without human intervention are examples of how AI can be used as a therapist.

Keywords— Depression, Psychotherapy, Interpersonal Therapy, Artificial Intelligence.

1. INTRODUCTION

Depression is a long-term mental illness characterized by persistent melancholy, loss of interest in social activities, disrupted sleep, atypical eating, exhaustion, and trouble concentrating. It greatly increases the overall burden of illness and is a prominent cause of disability around the world. Biological, psychological, social, cultural, and economic factors are only a few of the many risk factors for depression. Abuse of drugs or alcohol may exacerbate the disease [1]. Additionally neurological in nature, it is linked to structural and functional brain disorders [2]. The burden of sickness on the planet is strongly impacted by depression, which is a major cause of disability worldwide [3]. Because of its unknown etiology [4] and effects on morbidity, mortality, and the prognosis of other medical disorders, treating and managing depression presents considerable hurdles [5].

Medication-based and therapy-based treatments for depression can be roughly divided into two categories. Various drug classes, including monoamine oxidase inhibitors (MAOIs), tricyclic antidepressants (TCAs), selective serotonin reuptake inhibitors (SSRIs), serotonin and norepinephrine reuptake inhibitors (SNRIs), atypical antidepressants [14,15,16], and others, are used in medication-based treatment. A therapy-based approach, on the other hand, may include behavioral therapy [17, 18], cognitive-behavioral therapy (CBT) [19], problem-solving therapy (PST) [20, 21], Electroconvulsive therapy (ECT) [22], Vagus nerve stimulation (VNS) [23], and other approaches. However, multiple studies show that using both medication and therapy-based therapies at the same time produces the best results for treating depression. [24].

1. **COMBINATIONAL TREATMENT OF DEPRESSION**

From the start of treatment, sequentially after nonremission with a single-modality treatment, sequentially after remission to support the patient's recovery to prevent recurrence, or sequentially after remission. Combinational treatment with psychotherapy and antidepressant medication can be given. The best-supported approach to combination improves remission rates and lowers relapse and recurrence over the long term by sequentially adding treatments, notably psychotherapy following nonremission to antidepressant medication [25]. When a patient's depression is moderate to severe, they should also consider psychotherapy in addition to antidepressants. This is especially true if the patient's antidepressant prescription has only partially helped them or if they have had issues adhering to their antidepressant regimen [26]. As the limits of single-modality therapies have come to light, an increasing number of clinical trials have assessed the efficacy of combining psychotherapy with antidepressants to improve both short- and long-term outcomes [27, 28, 29].

Combining treatments has been shown to have a number of positive outcomes, such as a quicker response [30], improved long-term recovery rates [31], a lower rate of relapse [32], improved long-term social functioning [33], improved medication compliance [34], higher patient satisfaction [35], and lower long-term costs for healthcare and social services [36]. According to meta-analyses, when medication and psychotherapy are combined, the effects on improvement are less significant than when each therapy is used alone [37]. Moreover, meta-analyses of studies evaluating a wide range of patient populations have consistently revealed comparable small effect sizes in favour of combination treatment over medication alone [38] or psychotherapy alone. [39].

1. **INTERPERSONAL THERAPY**

Instead of concentrating on ingrained personality features, IPT tackles the patient's current social context and the symptom genesis and social dysfunction associated with depression. There are three phases to the therapy. The initial stage entails determining the patient's symptoms, making a depression diagnosis, and analysing their present social functioning and interpersonal interactions. Following that, the focus of treatment is on tying symptoms to particular areas of the patient's life where there are problems, such as grieving, conflicts over roles with others, role transitions, or interpersonal impairments. The development of methods to deal with the selected problem area occurs in the second phase. The patient's increasing independence and competence are supported during the last phase, which lasts 12–16 weeks, while the therapeutic advancement is solidified [40]. Individual, group, or couple's therapy can all be used to deliver it [41]. IPT's scientific accomplishments have its inclusion in clinical treatment guidelines and to growing interest in IPT among clinicians [42].

IPT, which has the potential to outperform some established standard psychotherapies, is acknowledged as a very effective form of psychotherapy [43]. IPT can produce outcomes that are equivalent to those of medicine, according to a number of research studies [44, 45, 46], and in some cases, it may even be more effective when used in conjunction with medication [47,48]. In addition, it has been discovered that combining IPT with medication is more beneficial than either one alone at preventing relapse [47,49]. Additionally, compared to when these interventions are performed individually, IPT in combination with other behavioral or psychological interventions has shown better remission rates [50, 51].

1. **USE OF ARTIFICIAL INTELLIGENCE (AI) FOR TREATMENT OF DEPRESSION**

AI in healthcare is anticipated to significantly alter how we analyze healthcare data, identify diseases, create remedies for them, and possibly even stop them from occurring entirely. Medical personnel can use artificial intelligence in the healthcare industry to make better judgments based on more accurate information, which will save time, money, and improve the overall management of medical records [52]. The present corona virus epidemic has demonstrated the value of mental health as well as the dangers of its ineffective management for both individuals and nations [53, 54,55]. Technology-based solutions could aid in reducing waitlists and inequities in access to therapy as a result of the limited clinical resources that are unable to keep up with the high incidence of mental illness. The use of chatbots and virtual assistants for mental health has gained popularity in recent years because to developments in artificial intelligence [56].

Facial Expression Recognition (FER) and Emotion Detection (EM) are two capabilities that Artificial Intelligence (AI) provides through its integrated Machine Learning (ML) and Deep Learning (DL) features. A subset of machine learning known as deep learning (DL) trains computers to learn by doing by simulating tasks that people do on a daily basis, like recognizing images, speaking, and organizing data. Contrary to conventional methods, DL recognizes patterns utilizing many layers of processing, allowing for constant improvement and adaptation. A more sophisticated use of analytics is made possible by this dynamic behavior. Early depression and anxiety diagnosis, intervention in probable suicide attempts, and early-stage treatment can all be made possible with the help of AI-driven tools like FER and Voice Recognition [57].

The widening gap between the expenses of hiring professionals and receiving therapy is what is driving the rising demand for virtual mental health solutions. Therapeutic apps can help people who are reluctant to seek help because of stigma and privacy issues by providing care in the privacy and comfort of their own homes. In contrast to people, AI software can store and use a vast amount of data to recognize mental health disorders and offer individualized care based on personal patterns and medical history. Even while an AI chatbots cannot entirely replace a human counselor, this alternate option motivates more people to seek therapy [58].

The vast majority of depression management use-cases for AI seem to fall into one of three categories: Virtual Counseling: Business organizations are creating software that uses machine learning to identify depressive episodes and to offer support through the use of natural language processing. Patient Monitoring: Machine learning is used to keep tabs on patients, forecast when a mental health crisis will start, and take steps to stop it from happening. Precision therapy: Companies are tracking and correlating cognitive function, clinical symptoms, and brain activity using machine learning analytics. However, there are a number of web-based programmes on the market that employ AI and machine learning for patient monitoring and counselling in the management of depression. These include, among others, Woebot, Wysa, Sunrise Health, Ginger.io, and Mind Strong Health [59].

Users of AI systems have emphasized beneficial features including accessibility and empathy [60]. Compared to users of non-AI-based programmes like eBooks, bibliotherapy, or text-based programmes, they reported higher happiness, enhanced learning skills, and a stronger therapeutic relationship [61, 62]. Additionally, users regarded chatbots as approachable, fascinating, instructive, and participatory [62]. They showed faith in the system and a good attitude towards using AI [63]. However, there is continuous discussion and scepticism over machines' capacity to faithfully decipher and react to the complete gamut of human emotions, as well as the possible consequences when these methods go awry. Artificial intelligence (AI)-based technology may be able to anticipate psychological suffering before it becomes severe, reducing the severity of mental disease and halting its progression into major depression [64].

1. **CONCLUSION**

This subject is important because AI has the potential to greatly enhance and personalise psychological interventions, improving patient reactions during therapy. This systematic review has offered preliminary evidence in favour of the addition of AI tools to psychotherapy in real-time or nearly real-time settings for emotional difficulties. Numerous research have shown the potential of AI in continuous psychological therapies, particularly when it comes to giving patients quick, individualised feedback and therapeutic direction. While existing research suggests some potential advantages, more research is required to support the notion that AI might enhance the job of psychotherapists by providing real-time information on patient progress and therapy suggestions. It is crucial to stress that AI seeks to improve accessibility and effectiveness in psychotherapy rather than taking the position of psychotherapists.

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