

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR



Basic Biomedical Engineering *Term Paper*

Mental Health in Biomedical Engineering

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Perseverance and passion, along with focused work in the proper direction, can lead to success. However, the harsh fact that the road to success is paved with a plethora of tempting, obstructions and traps can be discouraging. In such a case, it is the able advice of a knowledgeable person that guides one through the challenges and assists him in achieving success.

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Abstract

Mental health is indeed integral part of human health but nowadays several mental health issues like depression and anxiety are rising. Could the field of biomedicine provide a cure for depression? Biomedical engineering, depression, and mental health aren't often talked about in the same sentence. But the latest research proves that biomedicine can be beneficial for the brain. Biomedical engineers and psychiatrists are currently working together to find better, more effective ways of treating illnesses like depression. In this article we are going to discuss about mental health threats and Biomedical solution available for mental health.

1 Introduction

Mental health includes our emotional, psychological, and social well-being. It affects how we think, feel, and act as we cope with life. It also helps determine how we handle stress, relate to others, and make choices. Mental health is important at every stage of life, from childhood and adolescence through adulthood and aging. Mental illness is a global problem. More than 300 million people, 4.4% of the world's population, suffer from depression.

Importance of Mental health

Mental health is integral to living a healthy, balanced life. Our mental health encompasses our psychological, emotional and social well-being. This means it impacts how we feel, think and behave each day. Our mental health also contributes to our decision making process, how we cope with stress and how we relate to others in our lives.

Benefits of good mental health:-

- A Stronger Ability to Cope With Life's Stressors
- A Positive Self-Image
- Healthier Relationships
- Better Productivity

2 Threats to Mental health

The various threats which can affect our Mental Health are:-

2.1 Loneliness

Social media Age was meant to connect us, and in many ways it has, but it can also be argued that it has driven us to be more alone and distant than ever. Loneliness is the absence of imperative social relations and lack of affection in current social relationships. Research addressing loneliness has increased dramatically over the past 2 decades even in the age of social media loneliness is a common experience with 80% of population below 18 years of age and 40% of population above 65 years of age report loneliness at least sometimes in their life. Loneliness can cause several mental health problems like depression, anxiety, low self-esteem, sleep problems and increased stress..

2.2 Social Media

While many of us enjoy staying connected on social media, excessive use can fuel feelings of anxiety, depression, loneliness, and FOMO. Human beings are social creatures. We need the companionship of others to thrive in life, and the strength of our connections has a huge impact on our mental health and happiness. Being socially connected to others can ease stress, anxiety, and depression, boost self-worth, provide joy, prevent loneliness, and even add years to your life. On the flip side, lacking strong social connections can pose a serious risk to your mental and emotional health. Ironically for a technology that's designed to bring people closer together, spending too much time engaging with social media can actually make you feel more lonely and isolated—and exacerbate mental health problems such as anxiety and depression. The **Threats** Social media bring to our lives:-

- Insufficiency about your life or appearance (Body image issues)
- Depression and anxiety
- Loneliness
- Cyberbullying
- Fear of missing out (FOMO)

2.3 Social Stigma around Mental health

The stigma and resulting discrimination against people with mental health problems is a worldwide multifaceted problem. Stigma and discrimination can contribute to worsening symptoms and reduced likelihood of getting treatment. A recent extensive review of research found that self-stigma leads to negative effects on recovery among people diagnosed with severe mental illnesses. The need to get Educated about Mental health is also necessary.

The Technologies that can worsen Mental Health:-

2.4 Metaverse

Metaverse is a shift in how we interact with technology. If we think of the internet as two-dimensional, we can think of the Metaverse as three-dimensional. It is an immersive experience through the use of digital selves, or avatars. Metaverse has created a quite buzz in the whole world that how it's going to impact our mental health. Augmented and Virtual Reality existed earlier too but bringing them to social media level can increase the amount of risk that how badly it can affect our Mental health:-

- It can be very addictive as it can give you real life experience
- It can make people more lonely and isolated.
- Excessive digital use is associated with many mental health issues including depression, irritability, stress, paranoid ideation, somatic symptoms, and psychoses among others.

2.5 Sarco-The suicide machine

A coffin-shaped biodegradable capsule named Sarco has been created which allows users to kill themselves, and is now legal in Switzerland. The machine results in painless death of the occupant. The low level of oxygen inside the machine leads to the voluntary death of the person. Some Critics says that this machine is glamourising suicide because in the time in which millions of people are facing mental health issues should suicide machines be built. **Let's see the technologies that can actually improve mental health:-**

3 Repetitive Transcranial Magnetic Stimulation(rTMS)



Figure 1: Repetitive Transcranial Magnetic Stimulation

3.1 Introduction

When medication-based approaches to treating depression aren't working, doctors may prescribe other treatment options, such as repetitive transcranial magnetic stimulation (rTMS). This therapy involves using magnetic pulses to target specific areas of the brain. People have been using it since 1985 to relieve the intense sadness and feelings of hopelessness that can come with depression.

3.2 Working

During an rTMS session, an electromagnetic coil is placed against your scalp near your forehead. The electromagnet painlessly delivers a magnetic pulse that stimulates nerve cells in the region of your brain involved in mood control and depression. It's thought to activate regions of the brain that have decreased activity in depression.

3.3 Uses

The FDA approved rTMS to treat severe depression when other treatments (like medications and psychotherapy) haven't achieved enough effect.

4 Mobile Applications



Figure 2: Mobile applications

4.1 Introduction

Technology has opened a new frontier in mental health support and data collection. Mobile devices like cell phones, smartphones, and tablets are giving the public, doctors, and researchers new ways to access help, monitor progress, and increase understanding of mental wellbeing. Creative research and engineering teams are combining their skills to address a wide range of mental health concerns. Some popular areas of app development include:

4.2 Self Management apps

“Self-management” means that the user puts information into the app so that the app can provide feedback. For example, the user might set up medication reminders, or use the app to develop tools for managing stress, anxiety, or sleep problems. Some software can use additional equipment to track heart rate, breathing patterns, blood pressure, etc. and may help the user track progress and receive feedback.

4.3 Meditation Exercises apps

How does meditation improve mental health? The mental health benefits of meditation include better focus and concentration, improved self-awareness and self-esteem, lower levels of stress and anxiety, and fostering kindness. Meditation also has benefits for your physical health, as it can improve your tolerance for pain and help fight substance addiction. Many apps are designed to improve mental health through meditation.

4.4 AI-Chat Bots

Mental health chatbots provide a supportive presence to service users, engaging them with conversation at times when they feel low. Some chatbots engage passively, replying only when users reach out. Others can actively engage users that are on their site or have downloaded an app. So, they'll start conversations with users to check in with them. Mental health chatbots might simply provide a friendly ear. A place to air concerns, worries, intrusive thoughts or engage in 'therapeutic' small talk. They can use this conversational input to detect the mood of the service user and respond with empathy. Some chatbots can provide guidance or advice to help users challenge their negative thoughts. So, these chatbots will offer relevant tools and resources to help users find healthy coping strategies. (Spanning anything from meditation, to mental exercises, to self-help, etc.)

4.5 Digital Symptom tracking

Tracking mental health symptoms manually is time-consuming and inefficient. You fill out a paper form on your first therapist visit and then report any new symptoms at each in-person appointment. Providers record those symptoms to an electronic health record, which likely isn't optimized for data analysis. In contrast, online symptom tracking prompts patients to share data daily. An AI algorithm analyzes that data to identify patterns and alert providers in real time of any warning signs.

5 Virtual Reality



Figure 3: Virtual Reality

5.1 Introduction

Virtual Reality (VR) is a computer-generated environment with scenes and objects that appear to be real, making the user feel they are immersed in their surroundings. This environment is perceived through a device known as a Virtual Reality headset or helmet.

5.2 Medical Uses

Treat PTSD: The uses of VR include the treatment of posttraumatic stress disorder (PTSD). Using the VR technology the patient is exposed to the source of their disorder, for example, a battlefield. The rationale for this form of therapy is that exposing the patient to the source of their condition combined with relaxation training will enable them to adapt to the stress. Further as they are exposed to this gradually, the level of threat is removed, which then decreases their feelings of anxiety. It is expected that over time the patient will lose the feelings of anxiety caused by their condition.

Calmness: It can Bring a certain sense of calmness by visiting different places of the world at the comfort of their own home.

6 Telepsychiatry



Figure 4: Virtual Reality

6.1 Introduction

Telepsychiatry is the application of telemedicine to the specialty field of psychiatry. The term typically describes the delivery of psychiatric assessment and care through telecommunications technology, usually videoconferencing. Research indicates that telepsychiatry is just as effective as in-person treatment, and it may even be preferable for some people.

6.2 Medical Uses

- **Call Therapy**- with in-person psychiatric treatment, telepsychiatry providers can evaluate and diagnose, provide therapy, and prescribe medication through Phone or **VR boxes**.
- **Get updates of Therapy**-It can be used with admitted patients, as well, when mental status changes occur due to anxiety or stress.
- **Emergency Patients**-In the emergency room, remote specialists can “beam in” to consult with the patient and onsite staff for patients with mental health or substance abuse issues.

7 Musical Therapy



Figure 5: Virtual Reality

7.1 Introduction

Music therapy is the clinical use of music to accomplish individualized goals such as reducing stress, improving mood and self-expression. It is an evidence-based therapy well-established in the health community. Music therapy experiences may include listening, singing, playing instruments, or composing music.

7.2 Medical Uses

- **Victims of trauma and crisis**-If you've experienced trauma and crisis, you might have anxiety, stress and pain. Music therapy can help you with decreasing those three experiences, improving your mood, feeling confident and in control and providing a non-verbal outlet for emotions.
- **Individuals with mental health disorders**-If you're dealing with a mental health disorder, music therapy can help you with communication and expression, help you explore your thoughts and feelings, improve your mood and concentration and develop coping skills.

8 Conclusion

Mental health are vital part of our lives which affects our daily activities like how we think,take decisions,communicate and work etc.But nowadays several mental issues like depression and anxiety are rising.To solve this issues several doctors,psychiatrist and Biomedical Engineers are researching and continuously bringing out several solution to big mental health problems.Technology is bringing about a revolution in every field and mental health care is no exception. The ongoing COVID-19 pandemic has provided us with both a need and an opportunity to use technology as means to improve access to mental health care.The various mental health innovation we discussed like rTMS,Several mobile applications which track and treat our mental health problems,the virtual reality to treat PTSD,telepsychiatry bringing healthcare expert to your phone,and various kind of therapies like musical therapies.These innovations are proof that it will herald a new wave of regulating and monitoring of mental health around the globe.

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