

THE ROLE OF ARTIFICIAL INTELLIGENCE IN SUICIDE PREVENTION: OPPORTUNITIES AND CHALLENGES

Shipra Srivastava

Assistant Professor

Department of Psychology, Dayanand Girls Post Graduate College, Kanpur

ABSTRACT

Artificial Intelligence (AI) in suicide prevention acts as a practice tool by analyzing, predicting and intervening in high risk scenarios in utilizing Machine Learning (ML) and Natural Languages Processing (NLP) to detect pattern in medical records or social media. Opportunities include real-time crisis detection, predictive and risk assessment personalized support, while challenges involve data privacy algorithm bias, and ethical dilemmas regarding automated care. Overall, the existing body of review article, paper emphasizes the role of Artificial Intelligence in suicide prevention is Pinnacle for Medical Science.

Key words: Machine Learning (ML)

Natural Language Processing) (NLP)

Algorithm

INTRODUCTION:-

The world Health Organization (WHO) asserts that suicide is a significant global Health Problem. In 2016, the suicide rate was estimated to be 10.6 per 100,000 individuals, with 80% of those cases occurring in low income and middle income countries (**Fazal et al., 2020**). Often, individuals at risk of suicide do not seek help from their clinicians or communities due to fear of stigmatization and the possibility of forced medical treatment.

Furthermore, individuals with mental illness who represent a majority of suicide cases –may have limited awareness of their mental condition and may not recognize themselves as being at risk of suicide (**Picardo et.al, 2020**). This situation is further complicated by the difficulty clinicians or psychotherapists face in accurately identifying those at risk of suicide when they do seek medical care (**Walsh et al., 2018**).

In an effort to mitigate the impact of suicide, there is a growing interest in leveraging artificial intelligence (AI), data science and other analytical techniques to enhance suicide prediction and risk identification. Broadly these tools fall into two categories:

1-Medical Suicide Prediction Tools

2-Social Suicide Prediction Tools.

1- Medical Suicide Prediction Tools:- Involve clinicians and psychotherapists using AI techniques (i.e. natural language processing and machine learning) to identify patterns of information and behaviors indicative of suicide risk and to utilize data from electronic medical records and potentially other government data sources (**Nugent et.al, 2019**). These tools are typically employed in hospital settings or General Practitioner Clinics to support clinicians or psychotherapists with assessing patient suicide risk.

2-Social Suicide Prediction Tools:- On the other hand, involve AI and data tools that, analyze information from social media and browsing habits to assess suicide risks platforms like facebook, google and Apple, for example, may use data to identify users at risk of

suicide and then provide appropriate interventions, such as offering free information and counseling services (Coppersmith et.al, 2018; Muriello et. al, 2018). Lejeune et.al, (2022) conducted a review to evaluate the potential of AI in identifying patients at risk of attempting suicide. They performed a systematic review of literature using the Pub Med, EMBASE, and SCOPUS databases, with relevant keywords. Out of 296 studies identified, 17 studies published between 2014 and 2020 met the inclusion criteria and were deemed relevant. These studies focused on predicting individual's suicide risk or identifying at risk individuals within specific populations. This research article will explore three complementary questions: 1- First, how can AI help front line workers in suicide prevention and AID in the development of mental health promotion strategies?

2-Second, what ethical issues must be addressed in when using existing technologies in suicide prevention and detection of persons at risk, and in the development of new technologies?

3- Third how can we ensure that these technologies remain safe and effective for Mental Health workers, researchers, governments and suicidal individuals?

The assessment value of first question is existing with prolonged future benefits that AI assists frontline workers in suicide prevention by providing real time risk detection, automating administrative tasks to reduce burnout, and delivering 24/7 conversational support. By analyzing vast data sets, including electronic health records (EHRs) and social media, AI tools can identify high-risk individuals and provide predictive insights that improve clinical decision making. Frontline workers including crisis counselors, emergency responders, and community health workers, can use AI to manage heavy workloads and improve patient outcome.

Machine Learning Algorithms analyze linguistic cues, sentiment, and patterns in text-based crisis services (eg. text, chat, social media) to detect imminent suicidal intent, often more accurately than traditional methods. Tools like the VSAIL (suicidal Attempt and Ideation likelihood) modal analyze EHRs to estimate a patient's 30 day risk of attempting suicide, enabling clinicians to initiate proactive screenings during visits for unrelated issues. AI can analyze incoming messages in crisis centers, flagging urgent cases based on high-risk language and prioritizing them for human counselors.

It was found in studies that AI conversational partners can complement human supports offering immediate, consistent and emphatic interaction to those in distress while lowering barriers for individuals hesitant to share with a human. Digital phenotyping is an important AI tool by analyzing smartphone data (sleep patterns, activity levels, communication frequency), AI can detect behavioral shifts such as social withdrawal, that correlate with depressive relapses.

AI helps in developing proactive mental health promotion strategies by identifying trends and automating educational outreach: Mapping High-Risk Areas by AI which identifies geographical "Hotspots" of Suicidal behavior by analyzing social media and regional data, allowing policy makers to direct resources to understood high-risk communities.

AI-driven analyses have identified under researched risk factors such as "boredom" as a potential unique predictor, enabling the creation of more targeted prevention strategies.

AI-driven platforms can curate and deliver personalized educational materials on stress-management, emotional regulation, and resilience based on a user's behaviors patterns. Subsequently AI powered chat bots can offer confidential, anonymous support to individuals who might fear the stigma associated with seeking human help.

Second Assessment of Questions represent that integration of AI requires careful oversight. AI systems should be used as an adjunct to human expertise, not a replacement, as they may struggle to interpret subtle emotional nuances in complex cases.

Protecting user data and ensuring confidentiality is paramount, particularly when analyzing social media data. Several studies focus that AI model can inherit biases from training data, potentially leading to unequal treatment recommendations. AI decision making processes must be explainable to ensure accountability.

Assessment of the third question, enhances the reactions of mental health workers, researchers and suicidal individuals regarding AI benefits. It was found that AI technologies can be both safe and effective in mental health by implementing a hybrid approach that combines AI speed with human clinical oversight, particularly in high risk areas like suicide prevention. AI must be designed with explainability (XAI) rigorous validation, cultural sensitivity, and strict data privacy, serving as an augmented tool for professional rather than a replacement.

AI acts as an intelligent assistant to reduce administrative burden and enhance care quality: AI tools automate documentation, scheduling, billing and summarizing health records, allowing more time for patient interaction. Mostly Machine Learning Models (ML) analyze diverse data sources (Electronic Health Records, wearable sensors, speech) to support diagnosis and predict treatment responses (eg. identifying medication adjustments). AI systems can analyze therapy transcripts or passive data in real-time, alerting clinicians when a patient shows signs of deteriorating mental health or suicide ideation. Simultaneously AI acts as a “standardized patient” for trainee clinicians, allowing them to practice clinical skills in a safe environment.

AI provides immediate scalable support and early intervention lowering barriers to care. 24/7 AI driven chatbots, (eg. **Wysa**, **Woebot**) provide low intensity Cognitive Behavioral Therapy (CBT) and emotional support, which is often less stigmatizing than traditional therapy.

Eventually passive monitoring apps can identify subtle behavioral shifts (like increased sleep disruption or social withdrawal) that precede crisis, enabling proactive support. It was estimated that when AI detects high-risk language, it can immediately connect the user to human crisis counselors ensuring the “human touch” during critical moments.

AI accelerates research by analyzing vast data sets to identify new patterns and risk factors. AI processes massive volumes of social media data or EHRs to identify population-level trends in mental health, allowing researchers to study risk factors that are difficult to capture through traditional studies (eg. finding that boredom can be a unique suicide risk factor). It was reviewed that ML Algorithms help discover biomarkers (eg. speech patterns, eye movement) that improve the understanding and classification of mental illness.

Many researchers investigated that AI enables governments to map suicide rates and service availability, directing resources toward underserved or high-need areas. Governments such as the EU through the AI Act are developing frameworks that classify mental health AI as “high risks”, requiring human oversight, transparency, and data privacy compliance.

CONCLUSION:-

It can be concluded in this review article that almost suicide is a critical global public health issue, claiming hundreds of thousands of lives each year. It is often associated with complex mental health conditions such as depression, anxiety disorders and substance abuse. Mostly traditional methods of suicide prevention such as clinical assessment, counseling and crisis

helplines have been essential but are often limited by accessibility, stigma and resources constraints. In recent years, Artificial Intelligence (AI) has emerged as a promising tool to enhance suicide prevention efforts by enabling early detection, contains monitoring and timely Intervention. However, alongside its potential benefits, AI also raises important ethical technical and practical challenges.

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