Implementation of Chatbots in Mental Healthcare: A Human Factor Perspective

Zhenqi Zhao
Department of Business Information Technology
University of Twente
Enschede, Netherlands
e-mail: z.zhao-2@student.utwente.nl

Onur Asan
School of Systems and Enterprises
Stevens Institute of Technology
Hoboken, USA
e-mail: oasan@stevens.edu

Mo Mansouri
School of Systems and Enterprises
Stevens Institute of Technology
Hoboken, USA
e-mail: mmansour@stevens.edu

***Abstract*—The global prevalence of mental health disorders, accentuated by the COVID-19 pandemic, emphasizes an urgent need for efficient solutions. This paper explores the potential of chatbots in addressing the mental health situation from a human factor perspective. Using stakeholder analysis, we identified and categorized various entities that influence or are influenced by the integration of chatbots in mental healthcare. A shaping forces analysis revealed driving factors such as increasing student mental health needs, existing therapy system limitations, and technological advancements. While chatbots serve as promising alternative solutions for mental health crisis, they come with challenges. This study offers a fresh perspective on understanding the interaction between chatbots and mental healthcare. It underscores the effects of this transition not only on directly affected stakeholders but also on participants who might be indirectly influenced within the system.**

***Keywords*—Chatbot; Mental Health; Artificial Intelligence; Human Factors.**

I. INTRODUCTION

Nearly 970 million individuals worldwide grapple with mental illnesses, with the most common symptoms of anxiety and depression [1]. The outbreak of COVID-19 in 2020 exacerbated the situation [2]. Within a year, the number of people with anxiety disorders increased by 26% and the number of people dealing with depressive disorders grow by 28% [3]. Despite the availability of effective treatments, existing mental health care solutions remain insufficient for the global population. Chatbot applications, however, offer a promising solution.

Recent years have seen a growing interest in the integration of chatbots within the healthcare domain, leading to a variety of applications [4]. In an effort to mitigate the mental health crisis and ensure more accessible care, several public projects have been launched. In Europe, for instance, the Mental Health Monitoring Through Interactive Conversations (MENHIR) project was initiated, offering 24-hour mental health support via a chatbot [5]. Similarly, Ulster University introduced a chatbot called iHelpr, designed primarily to facilitate users in self-assessing stress, anxiety, and depression levels [6]. However, these tools are not yet broadly adopted.

This paper is structured into 5 sessions. Following this introduction, Section 2 covers background on mental health challenges, chatbots in the mental health field, and advancements in related technologies. Section 3 presents a stakeholder analysis. Section 4 discusses the shaping forces influencing chatbot adoption, and Section 5 concludes with findings and recommendations for future work.

II. BACKGROUND

The background section provides an overview of the current global mental health situation, the integration of chatbots in mental health, and the technological advances that power chatbots.

A. Current Mental Health Situation

Mental health conditions have become an increasing concern globally. Roughly one in eight individuals worldwide cope with mental disorders, with anxiety and depressive disorders being most common [7]. In the U.S., nearly 22.8% of adults faced mental illness in 2021 [8]. Despite the Netherlands having a slightly lower rate, the state of mental health is at its poorest in two decades, with 15% of the population admitting to psychological issues according to the Netherlands Statistical Office (CBS).

The COVID-19 pandemic only exacerbated these mental health challenges. Many studies point out a surge in depression, anxiety, and stress during the pandemic [2]. Factors such as enforced self-isolation and disruptions in daily routines might be attributed to increased loneliness, anxiety, insomnia, and even self-harm or suicidal tendencies [9].

Overall, the rising incidence and awareness of mental health issues reflect the need for timely solutions to address these challenges.

B. Chatbots in Mental Health

Conversational agents have been defined as ”software systems that mimic interactions with real people” [10] through various means such as text, spoken language, and gestures. A subset of these agents, chatbots, have gained attention in the healthcare sector due to their accessibility and efficiency. For instance, “Wysa” is a chatbot that engages users in written dialogues, recognizing their emotions and guiding them to build emotional resilience skills [11]. Another example, Emohaa, functions as a generative dialogue platform that facilitates open-ended conversations about emotional concerns, offering emotional support [12].

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However, current healthcare chatbots serve as supplementary tools rather than replacing medical professionals [13]. The majority of these chatbots develop based on decision trees. Only a small percentage utilize more advanced machine learning techniques [14]. Relying heavily on decision trees limits user inputs to predefined phrases and words and constrains the user's initiative in the conversation [4].

C. Related Technologies

The field of Artificial Intelligence (AI) has witnessed rapid advancements in recent years, notably advancing chatbot capabilities through two elements: Machine Learning (ML) and Natural Language Processing (NLP) [15]. Machine learning is a statistical technique for interpreting data, recognizing patterns, and utilizing historical conversation to generate appropriate responses [16]. Natural language process focuses on analyzing the nature of human language and facilitating machine comprehension and interpretation of user inputs [15].

Within healthcare, natural language learning has a multifaceted role, including interpreting user utterances, identifying significant changes, analyzing emotion, and extracting entities. Combined with ML, it can be used to predict or pinpoint behaviors in real-time, like identifying self-harm or suicide risk from interaction [15]. On the other hand, natural language learning can process unstructured patient notes and medical reports and transcribe patient discussions to provide unstructured data for facilitating relevant research [15].

However, the integration of chatbots into the mental health arena faces several challenges. One primary concern is the reliability of responses [4]. Due to the inherent design of machine learning, machine learning does not always guarantee consistent or desired outputs. In healthcare, particularly mental health, this unpredictability can pose risks. The integration of chatbots into daily clinical practice presents another challenge [16]. Gaining clearance from regulatory bodies often requires a thorough and extensive evaluation process. Lastly, the quality of chatbots is a salient issue. Many users feel that current chatbot dialogues lack depth and clarity, leading to confusion [17].

III. Stakeholder Analysis

A stakeholder analysis was conducted to better understand the diverse interests and potential impacts of involved groups. This section encompasses identifying possible stakeholders and classifying them based on the power-interest matrix.

A. Identification of Stakeholders

The current practice of chatbots in mental therapy is limited, necessitating a deeper exploration of their implications for stakeholders. Identifying the relevant stakeholders is the primary action. This study emphasizes three primary dimensions: the individual, organizational, and national levels, as illustrated in Figure 1.

At the individual level, the foremost affected stakeholders are the patients and the therapists. Subsequently, patients' family members bear indirect influences. Studies have shown

Figure 1. Identification of Stakeholders

that mental illness not only has the potential to cause physical illness in patients but also has the potential to jeopardize their lives. For instance, bipolar disorder has been linked to a higher cardiovascular disease rate [18]. Moreover, the study has demonstrated an association between suicidality and chronic insomnia [19]. Given the chronic and demanding nature of illness, the family caregivers often experience burnout and negative emotion, thereby imperiling their own well-being [20]. The widespread use of chatbots in the therapy field will grant more patients and their family members easier access to relevant information and treatments, helping their recovery. The health chatbots support therapists in managing their own health [21]; however, this trend may pose challenges to therapists in terms of job opportunities.

On the organizational level, both insurance companies and universities are likely to be affected. With the growing recognition of mental health, people are leaning towards insurance options covering therapy costs. Given that chatbots typically charge less than traditional face-to-face therapists due to the lack of need for physical workspace and human resource saving, this could lead to reducing expenses for insurance companies. Simultaneously, for universities, these digitized conversations offer invaluable firsthand data for research purposes.

Lastly, from a national perspective, governments should also focus on the mental health system. According to World Health Organization, over 700,000 people were estimated to have committed suicide in 2019 [7], which is one of the leading causes of death among young people [22]. In the U.S., a significant 16.5% of teenagers aged from 6 to 17 were diagnosed with mental disorders in 2016 [23]. It underscores the necessity for governments to address both physical and mental well-being of their citizens.

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B. Mapping of Stakeholders

Utilizing the power-interest matrix, stakeholders are categorized into four different groups based on their relative influences and interests in adapting the system. This mapping is depicted in Figure 2.

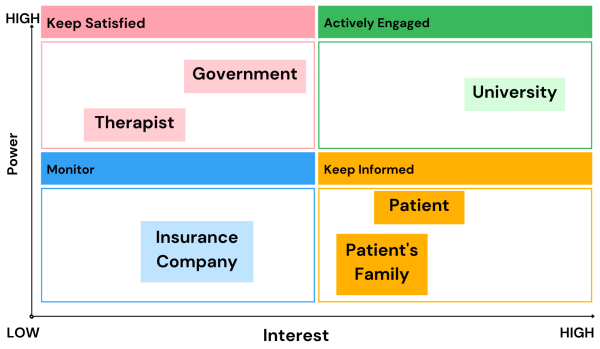

Figure 2. Power-Interest Matrix of Stakeholders

The government, a stakeholder at the national level, wields considerable influence but has a limited interest in chatbot development in the mental health field. The surge in mental health issues can be attributed to various causes, so the government has alternative solutions to address these issues. For instance, mental health challenges resulting from lockdown or quarantine are likely to subside post-pandemic. Therapists, on the other hand, have significant influence due to two primary reasons. First, developing chatbots requires extensive real data from past therapy sessions. Second, the sensitive nature of therapy demands rigorous validation before its widespread. However, many therapists favor direct interaction with patients and value immediate feedback, explaining their limited interest in chatbots.

Despite outstanding achievements in artificial intelligence and the deployment of chatbots by industries, the unclear commercial potential has limited private sector investment in this domain. In contrast, extensive research has been conducted in the academic sector, positioning universities as influential stakeholders. The wealth of data serves as an enticing factor for universities as well. Conversely, insurance companies exhibit both limited influence and interest due to a minor portion of insurance companies' claim expenses.

Patients and their families stand to benefit from the implementation of chatbots that may reduce associated costs. The limited understanding and social prejudices associated with mental disorders often deter many from seeking help. Chatbots offer a more private consultation environment, mitigating these concerns. However, due to the limited resources available to patients and their families, their influence remains modest.

IV. Shaping Forces Analysis

This shaping forces analysis examines key drives behind implementation of chatbots in the mental health field. As shown in Figure 3, three primary forces were discussed, including the demands of potential patients (students), the drawbacks of the current therapy system, and the burst of technologies.

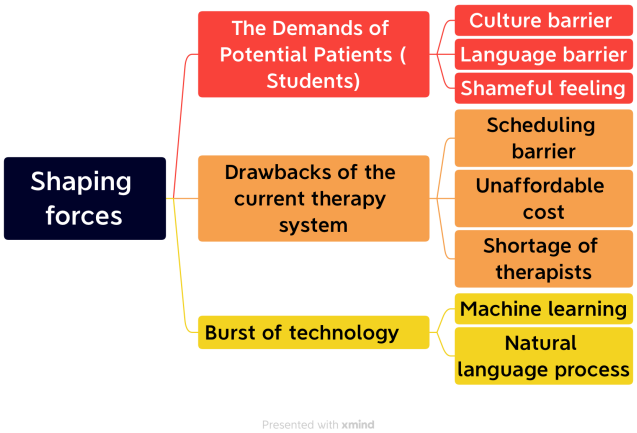

Figure 3. Shaping Forces Analysis

A. The Demands of Potential Patients (Students)

The attractiveness of diverse cultures has seen an uptick in students pursuing education abroad. However, this transition, coupled with rigorous academic demands, induces negative emotional states such as homesickness and loneliness. For instance, 45% of Chinese students at Yale exhibited depression symptoms, with 29% displaying anxiety symptoms [24]. Contributing factors include loss of familiar support networks, daily language barriers, and cultural adjustments [25]. Despite these challenges, international students often hesitate to seek help because of unfamiliar practice processes, cultural barriers, shameful feelings, and linguistic challenges.

Chatbots offer a potential solution by providing conversation in the student's native language. By leveraging data sourced from the native country, chatbots can effectively mitigate cultural barriers. Furthermore, the private platform can significantly reduce the stigma.

B. Drawbacks of the Current Therapy System

While seeking a recommendation for a cancer specialist is relatively straightforward, finding the right therapist is often more complex. Individuals' perceptions and feelings toward therapists can vary greatly, so it is necessary to make several attempts before finding a compatible fit. This journey, from searching for information to booking sessions, often becomes tedious, causing loss of motivation. Common barriers include the challenges of scheduling appointments and the overwhelming uncertainty of where to find help [25]. Another significant concern is cost. Notably, mental health treatments are not generally covered by private insurance policies, making it unaffordable for numerous families [26]. To compound these challenges, some countries, like China, face a shortage of qualified therapists and social workers [26].

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Chatbots, with their 24/7 availability, can efficiently overcome the challenges of appointment scheduling, potentially reducing therapy costs, and bridging the professional shortage gap.

C. Burst of Technologies

Figure 4 shows the number of publications related to Artificial Intelligence in mental health domain from 2013 to 2022, sourced from Scopus. This data was gathered using search terms: (”Mental Health” AND (”Artificial Intelligence” OR ”Machine Learning” OR ”Natural Language Process”)). The search was confined to the past decade and restricted to English language publications.

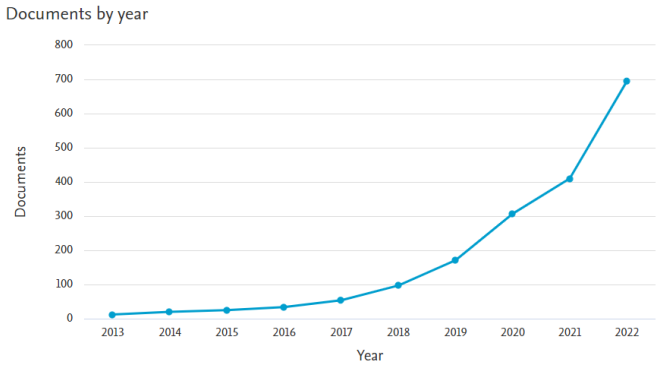

Figure 4. Publications Per Year

As mentioned before, the innovation of technology will be the gasoline for developing more advanced chatbots. A notable surge in publications is evident from 2017 onwards, offering a glimpse into the prospective growth trend in this area.

V. Conclusion and Future Work

The mental health situation is critical. As patient numbers surge, the apparent insufficiency of professionals becomes more pronounced. Despite society’s efforts to diminish the stigma associated with mental illness, many individuals still hesitate to seek help due to stigma. Additionally, the expense of therapy remains a financial burden for many. Chatbots offer a potential solution by providing 24-hour remote sessions. While earlier studies largely centered on the technological aspects of incorporating chatbots into mental healthcare or evaluated their impact solely from patient or therapist viewpoints, this paper broadens the scope. It not only considers the patients and therapists but also seeks to identify and analyze other stakeholders who may indirectly be impacted by, or have an influence on, the system.

However, potential challenges must be acknowledged. Data security stands out as a paramount concern. The related data requires meticulous storage to avoid any breaches and strict regulations to prevent any misuse. Another central issue is trust. Besides data security, patients must trust the advice offered by the chatbot and be willing to open up to chatbots. Since effective therapy hinges on trust, its absence could risk the therapeutic process being ineffective.

Future advancements should explore the potential of Large Language Models (LLMs) and Explainable AI. Large language models have demonstrated proficiency in simulating human-like conversations and achieving tasks in other domains. The integration could foster the development of AI-driven chatbots in therapeutic contexts. Explainable AI, meanwhile, can interrupt the decision-making process, minimizing inappropriate responses.

In conclusion, introducing chatbots in the mental health sector could promise unforeseen shifts, presenting both unique opportunities and challenges for the industry and patients.

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