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DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

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Human Computer Interaction in Mental Health

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C E R T I F I C A T E

This is to certify that the presentation entitled "**Human Computer Interaction in Mental Health**" is a bona-fide work carried out by by **Prateek M Gummaraju and Samartha S** bearing USN: **1BM19IS117** and **1BM19IS219** respectively, in partial fulfillment of the requirements for the VII Semester degree in **Bachelor of Engineering in Information Science & Engineering** of **Visvesvaraya Technological University, Belgaum** as a part of for the course **Biology for IT Engineers , Course Code - 20IS7BSBIO** during academic year 2022-2023.

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ABSTRACT

Human-computer interaction (HCI) is a multidisciplinary field of study focusing on the design of computer technology and, in particular, the interaction between humans (the users) and computers. HCI, which was first focused on computers, has recently broadened to include practically every aspect of information technology design.

Human Computer Interaction can be used positively to improve prediction, identification, coordination, and treatment by mental health care and suicide prevention services. AI is driving web-based and smartphone apps; mostly it is used for self-help and guided cognitive behavioral therapy (CBT) for anxiety and depression. Interactive AI may help real-time screening and treatment in outdated, strained or lacking mental healthcare systems.

INTRODUCTION

Human-computer interaction (HCI) is the field of study focused on how technology is used, both in theory and in practice. Research in this area is often focused on taking advantage of recent advancements in technology, psychology and sociology to improve the relationship that we have with our smartphones, wearables, computers, vehicles and other devices. From its origins, HCI would expand to incorporate multiple disciplines, such as computer science, cognitive science and human-factors engineering.

Although HCI emerged in the 1950s, its psychological aspects did not arise until the 1970s when cognitive engineering interfaced with computer science and technology. HCI prospered in the 1980s, becoming an important factor for computer scientists to design and develop successful computer UXs, notably graphical interfaces via multiple tiled windows with various applications - most commonly text processing and spreadsheets but also video games and the World-Wide-Web.

Human-computer interaction (HCI) has contributed to the design and development of some efficient, user-friendly, cost-effective, and adaptable digital mental health solutions. But HCI has not been well-combined into technological developments resulting in quality and safety concerns. The barriers for using AI in mental healthcare include accessibility, efficacy, reliability, usability, safety, security, ethics, suitable education and training, and socio-cultural adaptability.

During the Covid Pandemic, and post that, the amount of time spent by people in front of computer screens increased enormously. This was in part due to the increase in Work From Home and also as a form of escapism. This increase in screen time, for the most part, has had a negative impact on people's mental health. Moving forward, our screen time is only going to increase. We need to come up with ways to improve our mental health while mindfully engaging with the screen. Or, another interesting approach would be to use the digital medium to improve Mental Health of the public. With the advent of AI and Content Creation, we are not far away from this mark. Digital platforms and artificial intelligence (AI) have a good potential to improve prediction, identification, coordination, and treatment

by mental health care and suicide prevention services. AI is driving web-based and smartphone apps; mostly it is used for self-help and guided cognitive behavioral therapy (CBT) for anxiety and depression. Interactive AI may help real-time screening and treatment in outdated, strained or lacking mental healthcare systems.

IMPLEMENTATION

Web-Based and Smartphone Technologies:

Digital mental health therapies are primarily delivered by self-guided or guided approaches via online programs and apps which may be web apps or mobile apps. A systematic review conducted found Internet-based interventions with a cognitive behavioral focus are the most promising in reducing symptoms of depression in young people. An abundance of mental health-related apps via mobile and desktop devices increased the accessibility and use of internet-based mental health screening, treatment and after-care, as well as design for mental wellbeing. Innovative approaches are needed for digital mental health therapies to maximize their potential. In order to increase engagement, a mixed-methods study looked at how users of web-based and mobile interventions behaved and what they experienced. Data analysis identified differences between the intervention as a whole and its various components in order to show how passive data can be used to personalize care, ensure quality, and improve outcomes. Although clinical efficacy of Internet-delivered treatment systems was reported, criteria for measuring usability in light of current and appropriate design and technology should be defined.

HCI methods and knowledge may help to foster the digital therapeutic alliance (e.g., in mental health apps). A conceptual study proposed that HCI theories (i.e., persuasive system design, affective computing, eudemonic psychology and positive computing, and the human-smartphone connection) may contribute to a befitting, customized measure of the digital therapeutic alliance (as opposed to translating from traditional measures of the therapeutic alliance). A blended approach possibly using a combination of digital tools in addition to pharmaceuticals may elicit enhanced insights. A machine learning algorithm applied the NLP method in content analysis of SMS text messages on a digital mental health service platform (i.e., Talkspace) to identify users' COVID-19 pandemic-related concerns.

Artificial Intelligence:

AI such as computer vision, NLP, machine learning and reinforcement learning systems facilitates machines to perform sophisticated and anthropomorphic functions. Early evidence of HCI through affective NLP found that automated assistive systems have the potential to

emotionally respond from interpreting human language and an accumulation of sentiment from text and speech. In recent years, AI is being applied in multi-faceted ways: predictive tools are being tested and used to determine mental ill-health and suicide risks and to coordinate tailored treatment plans. Furthermore, therapeutic chatbots provide readily available support and interventions, including through video games.

AI technology design and use in mental health care has increased quality, accessibility, affordability, convenience, and efficiency. The main advantage of machine learning is that it is scalable and highly accurate in mental ill-health prediction, but it is mostly conceptual and lacking in empirical evidence, which limits its clinical application. The main disadvantages are a lack of information on model building and uncertain accuracy for suicide risk prediction, a lack of external evaluation of population studies, different evaluation approaches in cohort studies, and a lack of user-centered design processes that thwart HCI.

The adjunct potential of chatbots in mental health care is a good example of how HCI can be applied in research. A review of chatbots and conversational agents used in mental health found a small number of academic psychiatric studies with limited heterogeneity— there is a lack of high-quality evidence for diagnosis, treatment or therapy but there is a high potential for effective and agreeable mental health care if correctly and ethically implemented.

<u>Digital Phenotyping</u>

Digital phenotyping is personal sensing from capturing metadata. It subtly records how a user interacts with the device, and by combining sensor data, speech and voice data, and HCI, it may be able to bring precision to mental health diagnoses and results while also providing a picture of cognitive qualities and affective states. A HCI procedure involving digital biomarkers for cognitive function—a psychometric evaluation in conjunction with monitoring of the use of a smartphone app—found that it may be able to substitute for laboratory methods in a continuous ecological way.

The potential of digital phenotyping for assisting with effective care of young people with psychological distress called for research to address the practicalities of its future clinical application. Digital phenotyping is potentially useful to predict abnormal behavior, but it does not provide a causal explanation or psychological understanding of it. Digital sensory phenotyping may provide objective and continuous assessment which may facilitate better clinical interventions, but data security needs to be improved and further research is needed

to determine the utility of its data, evaluation and efficiency. The benefits of a blended approach of digital phenotyping with clinical assessment have been proposed. For example, digital phenotyping of passive data from smartphones and wearables in addition to questionnaire results could potentially measure the suicidal ideation process through ecological momentary assessment.

<u>Immersive Technologies</u>

HCI for computer and video games was limited to entertainment purposes until the 2000s, when pilot studies of serious video games emerged as an adjunct to psychotherapy for adolescents and a clinical intervention for schizophrenia, anxiety disorders and attention deficit hyperactivity disorders (ADHDs). Numerous studies have shown that using video games as a supplement to other treatments for ADHD may be successful. Video games support the therapeutic connection, according to an analysis of clinical studies with ADHD teenagers, but the HCI design needs to better take the target demographic into consideration to boost engagement and enhance the user experience.

Virtual Reality (VR) has been noted as becoming widely accepted in psychology and neuroscience as the most advanced form of HCI allowing individuals to act, communicate and be present in a computer-generated environment. Researchers and VR video game companies are working together for mental health support. The use of a VR biofeedback video game led to a decrease in trait anxiety, but like previous studies the game design did not meet expectations requiring more spatial opportunities for optimized engagement.

RESULTS

According to the integrative study, HCI has long been required to be more effectively incorporated into technological advancements for the provision of mental health care. There are problems with how psychology and psychiatry are traditionally practiced. For instance, clinical mental health diagnostic systems struggle to identify mental diseases in their earliest stages, and there are disparities caused by underfunded healthcare systems. The integration of predictive models with digital screening tools was proposed for faster and better assessment of the underserved for preventive and early intervention of mental health problems.

The design, development, implementation, and evaluation of digital mental health tools has the potential to help resolve systemic mental health care issues. Digital mental health tools best serve as an adjunct to mental health care, users and mental health practitioners can help improve effective outcomes through codesign of HCI. There are many web-based or smartphone technology products and services available which serve in telehealth and (self-)guided digital interventions as well as AI, immersive technologies, and digital phenotyping. But a lack of HCI investment has resulted in unrealized potential, a secure, trusted and eminent integrated-multimodal digital platform using AI has yet to be effectively designed, developed, used, strategized, funded and scaled.

FUTURE ENHANCEMENTS

Future research for enhanced quality, safety and usability may benefit from integrating a predictive model with HCI (i.e., adding real humans into the loop of simulations by computer algorithms that run human-created models).

It is important that HCI is better incorporated into technological developments for digital mental health (e.g., digital platforms and AI) resulting in higher quality, safety and usability. HCI modeling may help achieve these results by raising evidence-based digital health system design

<u>CONCLUSION</u>

In general, there is a need for automation and machine interaction that is faster and better, for higher degrees of efficacy evaluation, and for the use of blended, hybrid, or phased care as an adjunct strategy. In order to effectively understand, acknowledge, and address the disparities in mental health care and suicide prevention, as well as to design and develop useable applications, HCI modelling may be useful.

The adjunct strategy of incorporating digital mental health solutions into clinical care is encouraging, but mental health professionals must take on a bigger part in overcoming HCI obstacles and working with researchers, policymakers, governing bodies, and developers/entrepreneurs to find solutions for how to effectively design, develop, use strategize, fund, and scale products and services.

The design, development, implementation, and evaluation of digital mental health tools has the potential to help resolve systemic mental health care issues Digital mental health tools best serve as an adjunct to mental health care—users and mental health practitioners can help improve effective outcomes through codesign of HCI. It is important that HCI is better incorporated into technological developments for digital mental health (e.g., digital platforms and AI) resulting in higher quality, safety and usability.

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