Impact of Digital Transformation on Mental Healthcare: Opportunities, Challenges, and Role of AI Chat-bots in Symptom Management

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Abstract

Mental health disorders are a significant global health burden, and access to mental healthcare services remains a challenge. Digital transformation has emerged as a promising solution, but it also presents its own set of challenges. Objectives: This study aims to investigate the impact of digital transformation on mental healthcare, identify the opportunities and challenges it presents, and to examine the role of AI chat-bots in mental health symptom management. Drawing on a comprehensive literature review, a theoretical framework is developed, and five hypotheses are proposed. Methods: This study employs a cross-sectional survey design, collecting data from mental healthcare professionals in three countries. Structural equation modeling was used to test the hypotheses and examine the relationships among digital transformation, opportunities, challenges, AI chat-bot effectiveness, and mental health symptom management. Findings: The results provide support for the hypothesized relationships, highlighting the significant influence of digital transformation on opportunities and challenges, the impact of opportunities on AI chat-bot effectiveness, and the role of AI chat-bots in mental health symptom management. Novelties: This study contributes to the theoretical understanding of digital transformation in mental healthcare and offers practical implications for the development and implementation of effective digital mental health interventions.

1- Introduction

Mental health disorders are a significant global health burden, affecting millions of individuals worldwide. According to the World Health Organization (WHO), depression alone affects more than 264 million people globally [1]. The

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COVID-19 pandemic has further intensified the mental health crisis, with studies reporting increased rates of anxiety, depression, and stress among various populations [2]. Despite the high prevalence of mental health disorders, access to mental healthcare services remains a significant challenge. Many individuals face barriers such as stigma, financial constraints, and limited availability of mental health professionals, which prevent them from seeking the care they need [3]. Digital transformation in mental healthcare has emerged as a promising solution to address these challenges. The adoption of digital technologies, such as mobile applications, online platforms, and AI-powered chat-bots, can revolutionize the delivery of mental health services by improving accessibility, affordability, and engagement [4]. However, rapid digital transformation in mental healthcare also presents its own set of challenges. These challenges include concerns about data privacy and security, the need for evidence-based interventions, and the potential for digital technologies to intensify existing health disparities [5]. One area of particular interest in the field of digital mental health is the use of AI chat-bots for mental health symptom management. AI chat-bots have shown promise in providing accessible and cost-effective mental health support, with some studies demonstrating their effectiveness in reducing symptoms of depression and anxiety [6, 7]. However, further research is required to understand the factors that influence the effectiveness of AI chat-bots in mental healthcare and to explore the opportunities and challenges associated with their implementation.

Despite the growing body of research on digital mental health interventions, there is a lack of comprehensive studies that examine the complex interplay between digital transformation, opportunities, challenges, and the effectiveness of AI chat-bots in mental health symptom management [4, 5]. While previous studies have investigated the effectiveness of AI chat-bots in reducing symptoms of depression and anxiety [6, 7], further research is required to understand the factors that influence their effectiveness and to explore the opportunities and challenges associated with their implementation in the context of digital transformation in mental healthcare. This study aims to address this research gap by investigating two main research questions: (1) What are the opportunities and challenges of digital transformation in mental healthcare? (2) What is the role of AI chat-bots in mental health symptom management, and how is their effectiveness influenced by the opportunities and challenges associated with digital transformation?

To address the identified research gap and respond to the research questions, this study has three main objectives. First, this study provides a comprehensive examination of the impact of digital transformation on mental healthcare, identifying the specific opportunities and challenges it presents. Second, this study investigates the role of AI chat-bots in mental health symptom management, exploring their effectiveness and the factors that influence their implementation. Finally, this study aims to develop a holistic understanding of the complex interplay between digital transformation, opportunities, challenges, and the effectiveness of AI chat-bots in mental health symptom management, thereby informing the development and implementation of effective digital mental health interventions.

The contributions of this study are threefold. First, it addresses a critical research gap by providing a comprehensive examination of the impact of digital transformation on mental healthcare, considering both the opportunities and challenges it presents. Second, it contributes to the understanding of the role of AI chat-bots in mental health symptom management by exploring their effectiveness and the factors that influence their implementation. Finally, by developing a holistic understanding of the complex interplay between digital transformation, opportunities, challenges, and the effectiveness of AI chat-bots, this study informs the development and implementation of effective digital mental health interventions that can improve access to care and enhance mental health outcomes for individuals in need. These contributions have important implications for researchers, mental health professionals, policymakers, and technology developers working to harness the power of digital technologies to address the global mental health crisis.

The remainder of this paper is structured as follows: Section 2 presents the theoretical framework and hypothesis development, discusses the key concepts of digital transformation, opportunities, challenges, AI chat-bot effectiveness, and mental health symptom management, and proposes five hypotheses based on the literature. Section 3 describes the research methodology, including the study design, data collection, and analysis techniques employed. Section 4 reports the results of the study, presenting the findings from hypothesis testing and structural equation modeling analysis. Section 5 discusses the findings in relation to the existing literature, highlights the theoretical contributions, practical implications, and limitations of the study, and provides recommendations for future research. Finally, Section 6 concludes the paper by summarizing the key insights and emphasizing the significance of the study in advancing the understanding of digital transformation and AI chat-bots in mental healthcare.

2- Literature Review

2-1- Opportunities Driven by Digital Transformation

The rapid advancement of digital technologies has created numerous opportunities for transforming mental healthcare services. One of the most significant opportunities is the improved accessibility and convenience of mental health support through smartphone and mobile app interventions [8, 9]. These digital tools can engage mental health service users more effectively and reduce barriers to seeking help [10]. Furthermore, internet-based cognitive behavioral therapy (CBT) has emerged as a promising solution to overcome economic and geographical barriers, making evidence-based treatments more widely available [11, 12].

Digital transformation has also enabled therapists to interact with clients in their preferred environments, such as their homes, through teletherapy and virtual consultations [13]. This flexibility reduces the time, cost, and ethical barriers associated with traditional in-person therapy sessions [14]. Moreover, the blending of face-to-face sessions with web-based interventions has shown promising results in enhancing treatment outcomes and patient satisfaction [15, 16]. These opportunities highlight the potential of digital technologies to revolutionize mental healthcare delivery and improve access to effective treatments for a wider population.

2-2- Challenges Arising from Digital Transformation

Despite the numerous opportunities presented by digital transformation in mental healthcare, there are also significant challenges that must be addressed. One major challenge is the acceptability and affordability of digital mental health services, as some individuals may be hesitant to embrace new technologies or lack the necessary resources to access them [17]. Additionally, therapists in virtual clinics may struggle to effectively address mental health disparities among patients from diverse backgrounds, as digital tools may not always account for cultural, linguistic, or socioeconomic differences [18].

Another critical challenge is the variation in the prevalence and presentation of mental health conditions, such as anxiety and depression, across different racial and ethnic groups [19]. This diversity poses difficulties in developing and implementing digital interventions that are culturally sensitive and adaptable to the unique needs of various populations [20]. Furthermore, concerns regarding privacy, security, and confidentiality of sensitive mental health data in virtual environments present significant obstacles to the widespread adoption of digital technologies in mental healthcare [5].

Interoperability and data sharing issues between different mental health service systems also hinder the seamless integration of digital tools and the continuity of care across various platforms and providers [21]. Addressing these challenges is crucial to ensuring that digital transformation efforts in mental healthcare are inclusive, equitable, and effective in improving mental health outcomes for all individuals.

2-3- Hypothesis Development

Digital transformation has been a driving force in reshaping various industries, and the healthcare sector is no exception. The adoption of digital technologies has opened up new avenues for delivering mental health services, improving access, and enhancing patient outcomes. As mental healthcare organizations embrace digital transformation, they are presented with numerous opportunities to revolutionize the way they provide care. Torous et al. [22] highlighted that digital mental health interventions can bridge the gap between the high demand for mental health services and the limited supply of mental healthcare professionals. Digital tools, such as mobile applications and online platforms, can extend the reach of mental health services, making them more convenient and accessible to a wider population [23].

Moreover, digital transformation in mental healthcare has paved the way for innovative approaches to treatment, such as internet-based cognitive behavioral therapy (CBT). Egher [24] found that internet-based CBT is effective in treating various mental health conditions, including depression and anxiety disorders. The integration of digital technologies has also enabled mental healthcare providers to offer more personalized and engaging interventions. Bond et al. [4] argued that digital mental health interventions can be tailored to individual needs, preferences, and circumstances, leading to improved patient adherence and better treatment outcomes. Furthermore, digital transformation has facilitated the blending of face-to-face therapy sessions with web-based interventions, creating a more comprehensive and flexible approach to mental healthcare delivery [15]. The aforementioned evidence suggests that digital transformation in the mental healthcare sector presents significant opportunities for improving the quality, accessibility, and effectiveness of mental health services. As mental healthcare organizations invest in digital technologies, upgrade their infrastructure, and integrate digital tools into their existing systems, they are likely to experience the benefits of increased patient engagement, expanded reach, and enhanced treatment outcomes. Therefore, the first hypothesis (H1) of this study is expressed as follows:

H1: Digital transformation positively influences opportunities for improving mental healthcare services.

Digital transformation has undoubtedly brought about significant changes in the mental healthcare sector, presenting numerous opportunities for improving service delivery and patient outcomes. However, the adoption of digital technologies in mental healthcare also comes with its own set of challenges that can hinder the effective implementation and utilization of these innovations. One of the primary challenges is the acceptability and affordability of digital mental health services. Vindigni [25] found that while patients generally have positive attitudes toward digital mental health interventions, concerns about privacy, security, and the impersonal nature of technology can act as barriers to acceptance. Additionally, the cost of implementing and maintaining digital infrastructure can be a significant hurdle for mental healthcare organizations, particularly those with limited resources [22].

Another challenge associated with digital transformation in mental healthcare is persistent mental health disparities among different patient populations. Despite the potential of digital technologies to bridge the gap in access to mental

health services, Kolasa [26] argues that the digital divide can intensify existing inequalities because certain demographic groups may have limited access to or familiarity with technology. Furthermore, the lack of diversity in the development and testing of digital mental health interventions can lead to tools that are not culturally sensitive or responsive to the needs of diverse patient populations [27]. Privacy and security concerns also pose significant challenges in the digital transformation of mental healthcare. As sensitive patient data are increasingly stored and shared electronically, the risk of data breaches and unauthorized access becomes a pressing concern [5]. Mental healthcare organizations must navigate complex legal and ethical considerations surrounding data privacy and security, which can be a daunting task in the rapidly evolving digital landscape.

The challenges outlined above highlight the complexity of digital transformation in the mental healthcare sector. As mental healthcare organizations adopt digital technologies, they must be mindful of the potential barriers to acceptance, affordability, and equitable access. They must also prioritize the development of culturally sensitive and inclusive digital interventions while ensuring the privacy and security of patient data. Consequently, the second hypothesis (H2) of this study is designed as follows:

H2: Digital transformation poses significant challenges for mental healthcare organizations, which can hinder the effective implementation and utilization of digital technologies in mental health services.

The digital transformation of the mental healthcare sector has presented numerous opportunities for enhancing the delivery and effectiveness of mental health services. One of the most promising developments in this context is the emergence of AI-powered chat-bots as a tool for providing accessible, convenient, and personalized mental health support. As mental healthcare organizations capitalize on the opportunities brought about by digital transformation, they are increasingly turning to AI chat-bots to improve the effectiveness of their services. Hamdoun et al. [28] highlighted the potential of conversational agents, such as chat-bots, to deliver mental health interventions in a scalable and cost-effective manner. The authors argue that AI chat-bots can provide 24/7 support, reduce the stigma associated with seeking help, and offer a more engaging and interactive experience than traditional self-help materials.

The effectiveness of AI chat-bots in mental healthcare is closely linked to the opportunities presented by digital transformation. For instance, the integration of AI chat-bots into mobile applications and online platforms has made mental health support more accessible and convenient for users. Sabour et al. [29] found that AI chat-bots can effectively deliver cognitive-behavioral therapy (CBT) techniques, helping users to manage symptoms of depression, anxiety, and other mental health conditions. Moreover, the natural language processing (NLP) capabilities of AI chat-bots enable them to understand and respond to users' emotional states, providing empathetic and personalized support [30]. As mental healthcare organizations leverage the opportunities afforded by digital transformation, such as the availability of large datasets and advanced analytics, they can further enhance the effectiveness of AI chat-bots by training them on more diverse and representative data [31].

The growing body of evidence supports the notion that the opportunities brought about by digital transformation can significantly enhance the effectiveness of AI chat-bots in mental healthcare. As mental healthcare organizations embrace digital technologies and integrate AI chat-bots into their service offerings, they can expect to see improvements in patient engagement, treatment adherence, and overall mental health outcomes. The ability of AI chat-bots to provide accessible, personalized, and evidence-based support, combined with the scalability and cost-effectiveness of digital interventions, makes them a powerful tool in the arsenal of mental healthcare providers. Thus, the third hypothesis (H3) of this study is developed as follows:

H3: Opportunities presented by digital transformation positively influence the effectiveness of AI chat-bots in delivering mental health services.

The effectiveness of AI chat-bots in delivering mental health services has been a topic of growing interest in recent years. As digital transformation continues to shape the mental healthcare landscape, AI chat-bots have emerged as promising tools for improving mental health symptom management. The ability of AI chat-bots to provide accessible, personalized, and evidence-based support has significant implications for the way mental healthcare organizations approach the management of mental health symptoms. A study by You et al. [6] found that an AI chat-bot based on cognitive-behavioral therapy (CBT) principles was effective in reducing the symptoms of depression and anxiety among college students. The authors highlight the potential of AI chat-bots to provide a scalable and cost-effective means of delivering mental health interventions, particularly in settings where access to traditional therapy is limited.

The effectiveness of AI chat-bots in mental health symptom management can be attributed to several key factors. First, AI chat-bots are available 24/7, allowing users to access support whenever they need it, without the constraints of traditional office hours or appointment schedules. This constant availability can be particularly beneficial for individuals experiencing acute symptoms or crises [7]. Second, AI chat-bots can be programmed to deliver evidence-based interventions, such as CBT techniques, which have been shown to be effective in managing various mental health conditions [32]. By providing structured, goal-oriented support, AI chat-bots can help users develop coping strategies, challenge negative thought patterns, and build resilience. Finally, the natural language processing (NLP) capabilities of

AI chat-bots allow them to understand and respond to users' unique needs and preferences, providing a more personalized and engaging experience [33]. This tailored approach can enhance treatment adherence and improve overall mental health outcomes.

As the effectiveness of AI chat-bots in mental healthcare continues to be demonstrated through research and real-world applications, mental healthcare organizations are increasingly recognizing their potential to revolutionize mental health symptom management. By leveraging the capabilities of AI chat-bots, these organizations can expand access to mental health support, reduce the burden on traditional mental health services, and empower individuals to take a more active role in managing their own mental well-being. Therefore, the fourth hypothesis (H4) of this study is considered as follows:

H4: The effectiveness of AI chat-bots in delivering mental health services positively influences mental health symptom management.

The effectiveness of AI chat-bots in supporting mental health symptom management is not without challenges. Challenges such as acceptability, affordability, privacy and security concerns, and the ability to address mental health disparities can significantly mediate the relationship between AI chat-bot effectiveness and mental health symptom management. A study by Topal Koc & Mercan. [34] found that users' perceptions of privacy risks and the lack of trust in AI chat-bots can hinder their willingness to engage with these technologies, thereby limiting their potential to support mental health symptom management. Additionally, the affordability of AI chat-bots and the digital infrastructure required to support their implementation can create barriers to access, particularly for mental healthcare organizations with limited resources [8].

Moreover, the challenges associated with addressing mental health disparities through AI chat-bots can further mediate their effectiveness in managing mental health symptoms. As mentioned in H2, the lack of diversity in the development and testing of AI chat-bots can result in technologies that are not culturally sensitive or responsive to the needs of diverse patient populations [35]. This can limit the effectiveness of AI chat-bots in providing equitable and culturally appropriate mental health support, ultimately affecting their ability to manage mental health symptoms across diverse patient groups. To effectively leverage the potential of AI chat-bots in mental health symptom management, mental healthcare organizations must proactively address these mediating challenges. This may involve collaborating with chat-bot developers to ensure that the technology is designed with privacy, security, and cultural sensitivity in mind, as well as investing in digital infrastructure and training to support the effective implementation and use of AI chat-bots across diverse patient populations [17]. By addressing these challenges, mental healthcare organizations can create an environment in which AI chat-bots can more effectively support mental health symptom management and improve patient outcomes. Hence, the fifth hypothesis (H5) of this study can be described as follows:

H5: Challenges associated with the implementation and adoption of AI chat-bots mediate the relationship between AI chat-bot effectiveness and mental health symptom management.

Figure 1 presents the proposed conceptual model of this study, which illustrates the hypothesized relationships among digital transformation, opportunities, challenges, AI chat-bot effectiveness, and mental health symptom management.
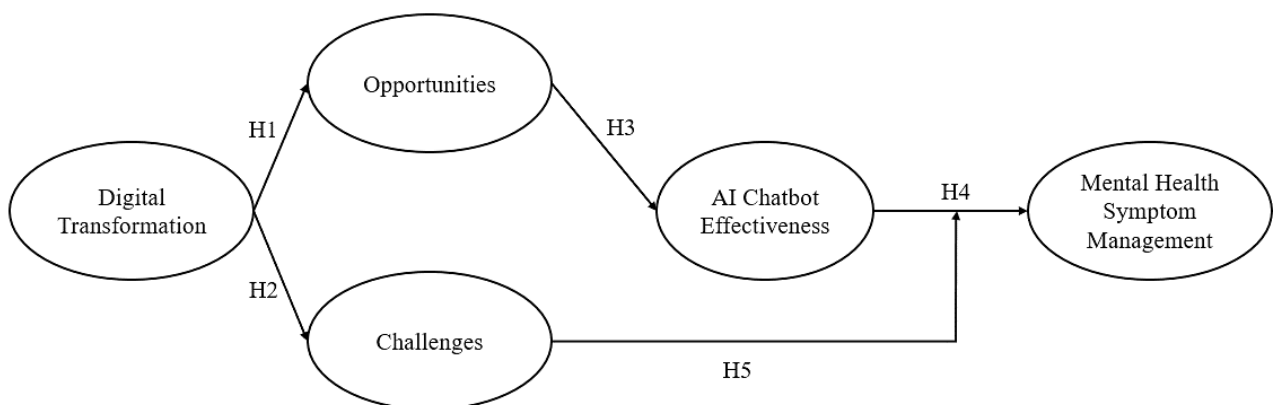
Figure 1. Proposed Conceptual model of the study

The model consists of five hypotheses (H1 to H5), which were developed on the basis of the literature review and theoretical framework. H1 and H2 propose that digital transformation positively influences opportunities and challenges in mental healthcare, respectively. H3 suggests that opportunities positively influence AI chat-bot effectiveness, while H4 posits that AI chat-bot effectiveness positively influences mental health symptom management. Finally, H5 proposes

that challenges mediate the relationship between AI chat-bot effectiveness and mental health symptom management. The conceptual model provides a comprehensive framework for examining the complex interplay between the key constructs and guides the empirical investigation of the study.
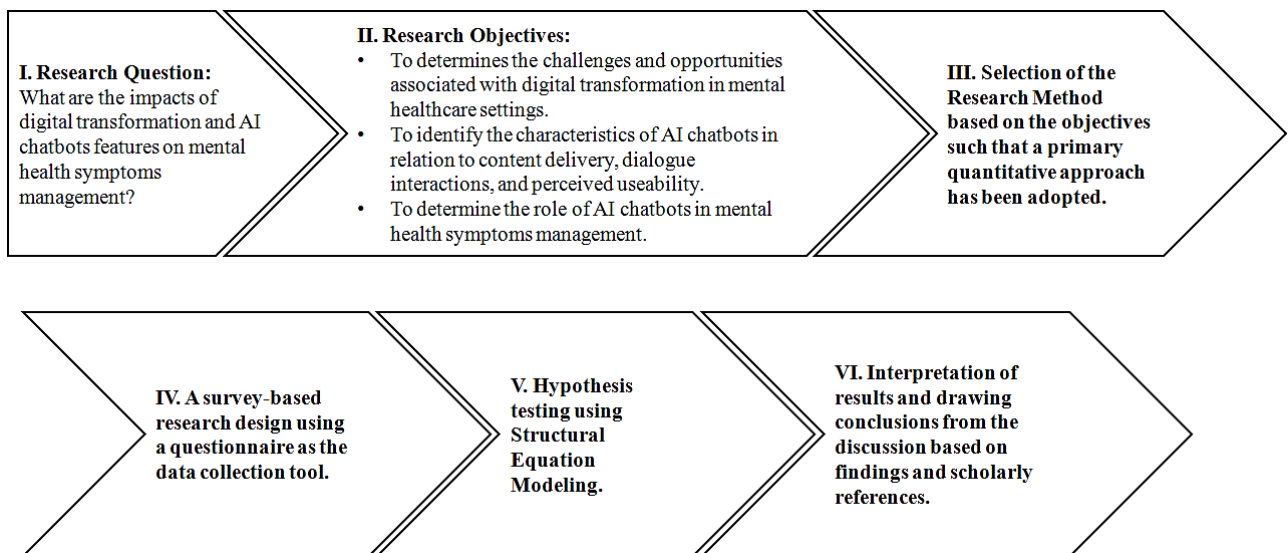
3- Research Method

3-1- Research Model

Understanding the previous discussion in the literature and from the theoretical prepositions, it has been projected that the important independent features associated with AI chat-bots are content delivery, dialog interactions, and perceived usefulness. The development of these features may be affected by demographic variables such as age, gender, and social class among service users, which are relevant parameters that should be considered when developing chat-bot content. More specifically, these would impact the language and communication style of chat-bots and develop communication preferences based on cultural sensitivity. Thus, these variables should also be recorded. These features affect how AI chat-bots function to manage the problems of service users.

At present, the analysis is carried out to assess the impact of such variables like content delivery, dialog interactions, and perceived usefulness in managing mental health symptoms from the healthcare perspective.

For the proper development of the model, this paper provides a structured model representing the problem, variables, conceptual proposition for method, study design, method, data collection method, and analysis. Figure 2 better represents the model for clarifying the steps of research design.

Figure 2. Represents the research model that illustrates the basic steps in which the entire methodology was developed for impact analysis of AI chat-bot features for mental health symptom management

3-2- Research Diagram

This study developed a specific flowchart depicting recruitment, data collection, processing, and analysis (Figure 3). The process flowchart guided the stages through which the whole research process was carried out.

3-3- Research Design

Based on the model, this study chose an empirical quantitative approach to data collection and analysis. This study used a cross-sectional survey-based design to collect data in real time at a single timeframe [36]. The choice of this design was due to the ease, access, and feasibility of conducting a survey. Considering the large, represented sample, a cross-sectional design is useful to collect knowledge at one point rather than a longitudinal analysis, which is more intensive. In addition, the research aimed to determine the perspectives of MHPs regarding digital transformation and AI and did not focus on the changing trends. The focus is mainly on understanding the features of AI; therefore, cross-sectional design across a large sample would have collected sufficient evidence. The study produced numerical data by collecting participants' ratings on a scale of variables that were tested and interpreted.

3-4- Research Setting

The research developed a web-based questionnaire through Google Forums for different geographies, including South Korea, Russia, and Indonesia. Thus, the research did not have a physical or experimental setup but was conducted via online channels such as Facebook and email.
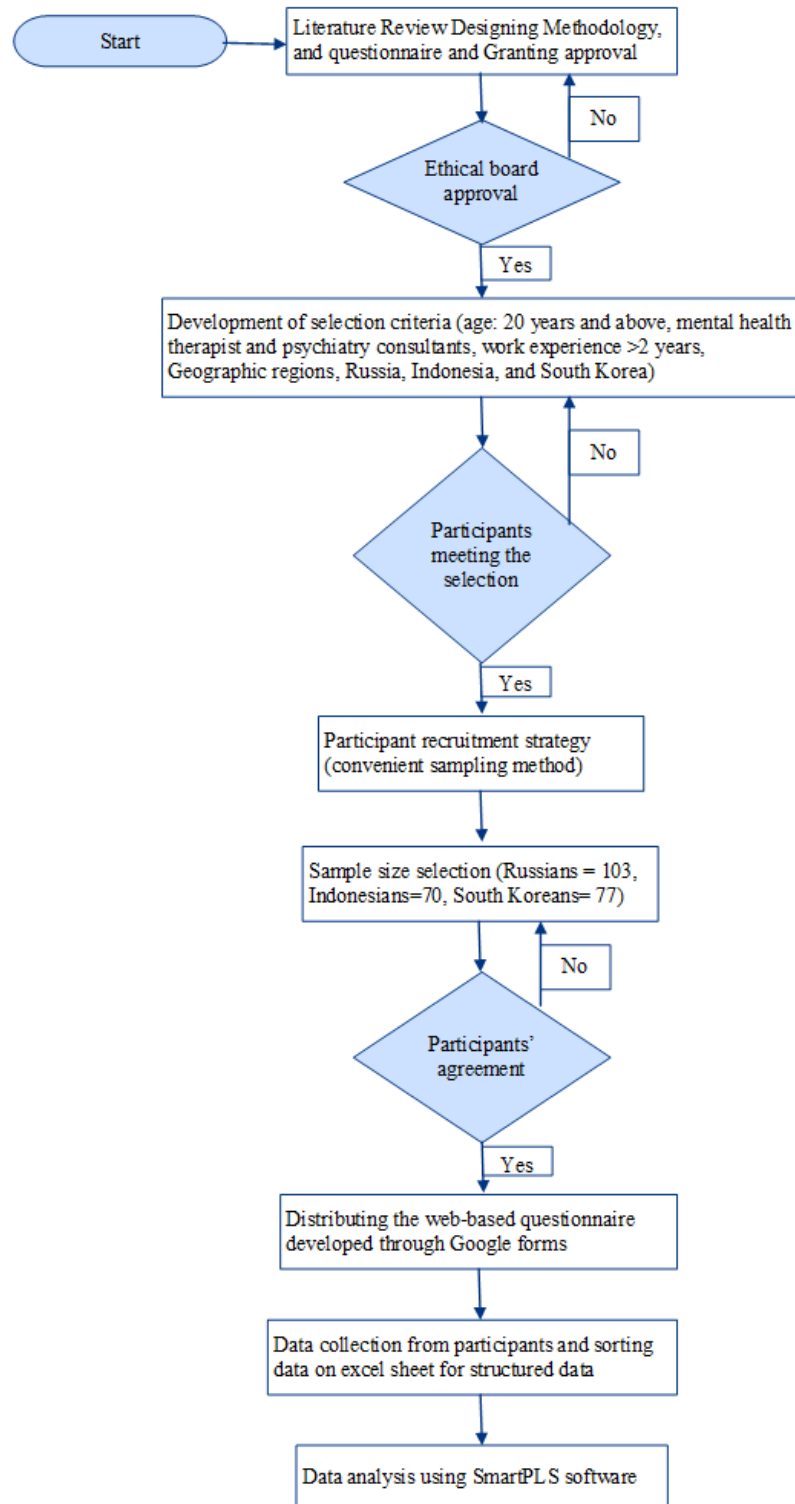
**Figure 3. A flowchart depicting the stages of recruitment, data collection, and analysis in primary research**

3-5- Sample Size and Participant Recruitment

The research targeted psychiatric consultants and therapists who possess expert knowledge in the field of interest. The choice of these participants was based on their geographical location and their employment as mental healthcare workers. More specific details are provided in Table 1.

Table 1. Demographic distribution

Characteristics	Frequency
Age	
>45 years	31
20–30 years	60
31–35 years	76
36–45 years	83
Gender	
Female	94
Male	156
Geographies	
Russian	103
Indonesian	60
South Korean	77
Position	
Therapists	187
Psychiatry Consultant	63
Work Experience	
>10 years	121
10 years	62
5 years	63
2–3 years	4

However, thousands of expert psychiatrists and therapists would be present in the three regions, which would require a sample representative of the population. For survey-based designs, an estimated sample of participants is usually suggested, which can also reduce the effort of time and money and can reduce the risks of false-positive results in the study that may occur due to a very large sample size [37]. However, three geographic regions were selected, which may require a large sample size. Figure 4 illustrates participant enrollment and sample size selection, such as assessing how appropriate sample numbers were decided. Recruitment was performed using a convenient sampling method due to its feasibility and less time-consuming recruitment [38].
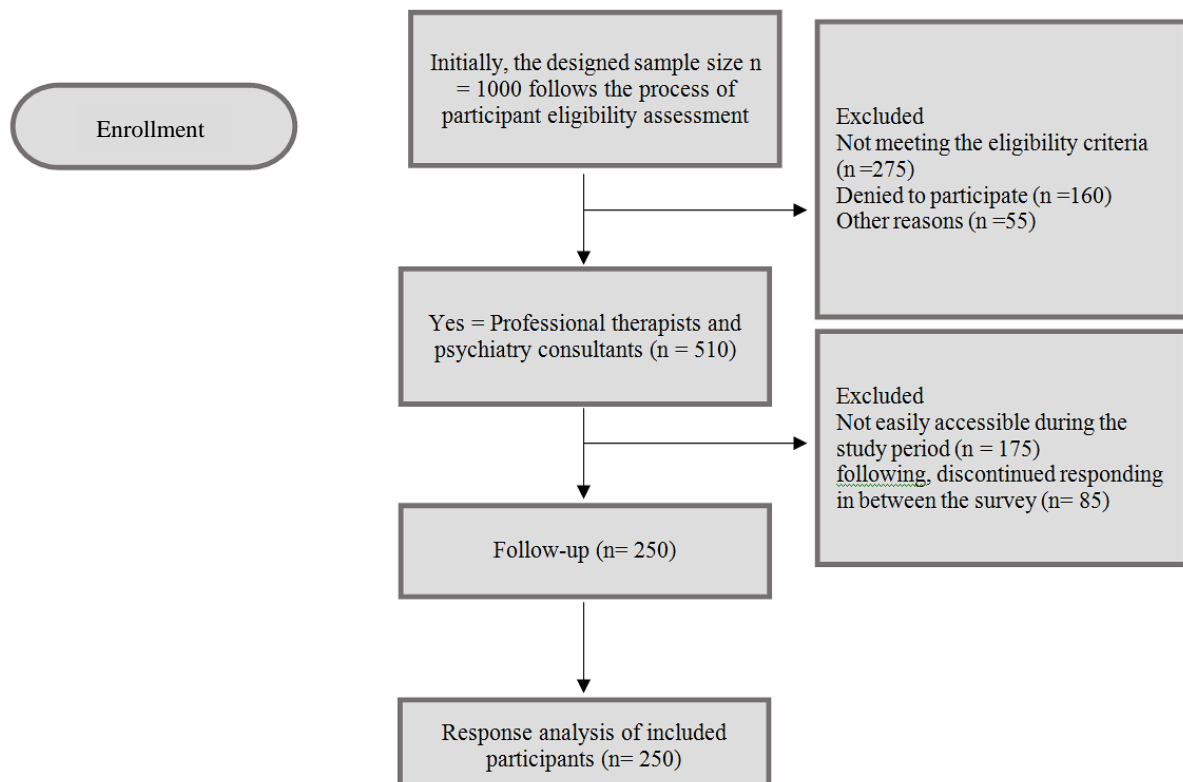
Figure 4. Participants selection (the enrollment, and participant eligibility for the sample selection, numbers, and final inclusion)

3-6- Data Collection Tool

In this study, a comprehensive questionnaire was developed to collect data on the key variables of interest. The questionnaire was designed to measure five main constructs: Digital Transformation (DT), Opportunities, Challenges, AI Chat-bot Effectiveness, and Mental Health Symptom Management. The items for each construct were carefully crafted on the basis of the existing literature and the specific context of the study. Table A-1 in the Appendix summarizes the variables and their corresponding measurement items. Each variable is considered a single latent variable, and the items are designed to capture the essence of the construct.

The questionnaire employs a 5-point Likert scale, ranging from 1 to 5 (1= Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly agree), to measure respondents' level of agreement or disagreement with each statement, allowing for a balanced and nuanced assessment of their perceptions and experiences related to the key variables of the study. Respondents were asked to select the option that best represented their level of agreement or disagreement with each statement. This 5-point Likert scale allows for a balanced and nuanced assessment of the respondents' perceptions and experiences related to the key variables of the study.

The Digital Transformation (DT) construct is measured using 8 items that assess the adoption of digital technologies, infrastructure upgrades, policy changes, organizational readiness, investment, availability of digital tools, digital literacy of professionals, and integration of digital technologies in mental healthcare systems. The Opportunities construct is measured using 5 items that evaluate the potential benefits of digital transformation, such as improved convenience and engagement, overcoming barriers, blending face-to-face and web-based interventions, and integrating technology into various mental healthcare services. The Challenges construct is measured using 5 items that assess the potential obstacles and difficulties associated with digital transformation, such as acceptability and affordability issues, addressing mental health disparities, privacy and security concerns, and interoperability and data sharing problems. The AI Chat-bot Effectiveness construct is measured using 5 items that evaluate the perceived effectiveness of AI chat-bots in performing various tasks, such as screening and diagnosis, understanding tone and emotions, triaging, providing referrals, and creating a human-like conversational experience. Finally, the Mental Health Symptom Management construct is measured using 5 items that assess the potential impact of AI chat-bots on managing mental health symptoms, such as understanding user needs, providing empathetic responses, offering therapeutic interventions, acting as virtual therapists, and promoting independence and self-management.

3-7- Data Collection Procedure

During this procedure, the participants were recruited by providing informed consent. The therapists and psychiatrists are mainly busy professionals; therefore, the time to conduct the questionnaire was set during the signing of the consent. This consent informed that the professional's rights for autonomy were respected, and they knew about the purpose of the study and its benefits for the care services and service users' safety. After recruitment, questionnaires were disseminated among selected participants, which took about 15 to 20 minutes to complete the survey form. The participants were required to mark the sections that suit their demographics in Part A, whereas in Parts B, C, and D, they responded to the statements in numerical form based on their knowledge and experiences with the use of AI chat-bots. The data was collected only once, and because of the different schedules, the participants were divided into groups to conduct the one-time survey.

3-8- Data Analysis

To test the proposed theoretical framework of this study, partial least squares-based structural equation modeling (PLS-SEM) was applied using SmartPLS 4. PLS-SEM provides us with the opportunity to simultaneously test the measurement model and structural model. On the other hand, using this approach allows us to simultaneously see all the relationships, including direct and indirect relationships, among the model variables.

4- Results

4-1- Demographic Results

The study reported demographic information by finding the percentages whereby the results showed that more participants were male (59.6%) and fewer were female (34.8%). In the age groups, more participants were from the age group 36–45 years (33.2%), which was attributed to their level of experience in the field. The health professionals had significant experience in the field and expert knowledge, attributed to their number of years of experience. Nearly half of the participants had more than 10 years of experience in the field, reflecting their expert knowledge of digital transformation in the field of mental healthcare. The graphs provide illustrative results for demographic information (Figures 5 to 9).
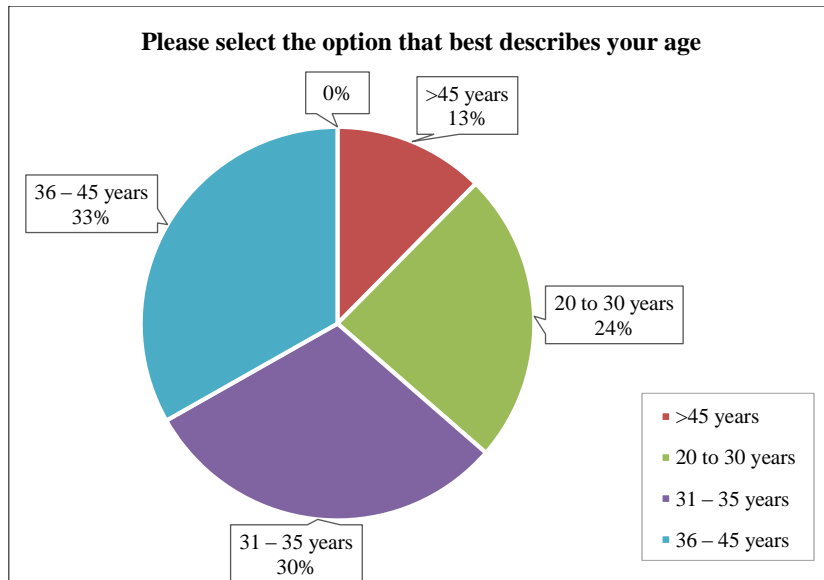
Figure 5. Participants' age groups. (>45 years = 12.4%, 20-30 years = 24.0 years, 31-35 years = 30.4%, 36-45 years = 33.2%)
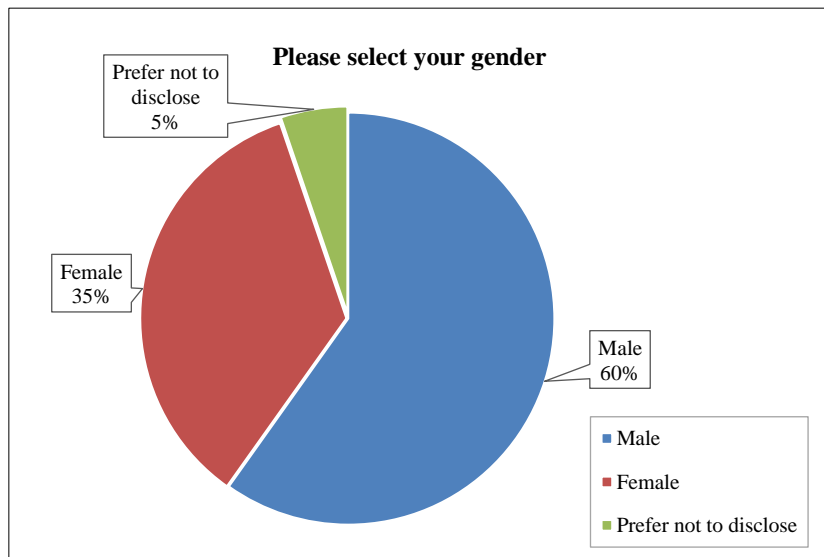
Figure 6. Participants' gender distribution (59.6% of participants were male, 34.8% of participants were female and 5.2% chose not to reveal their gender identity)
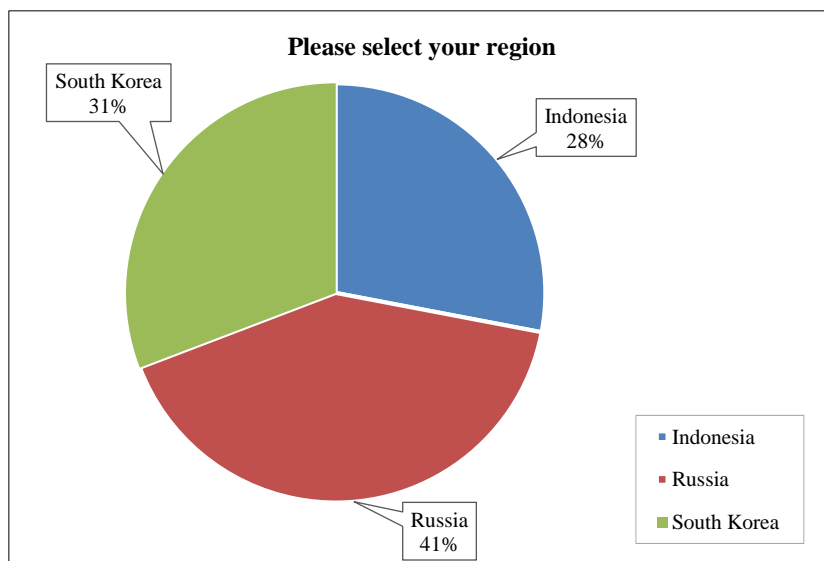
Figure 7. Geographical distribution of participants (41,2% of participants were from Russia, 30,8% from South Korea, and 28% from Indonesia)
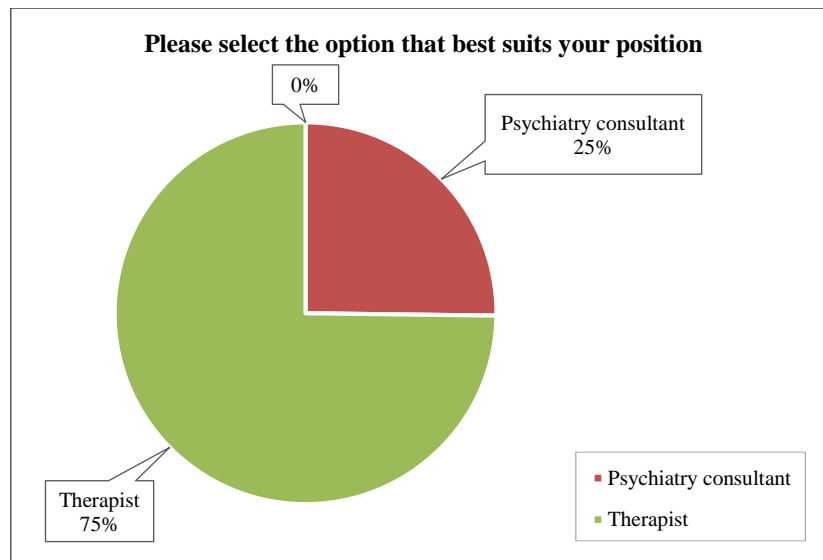
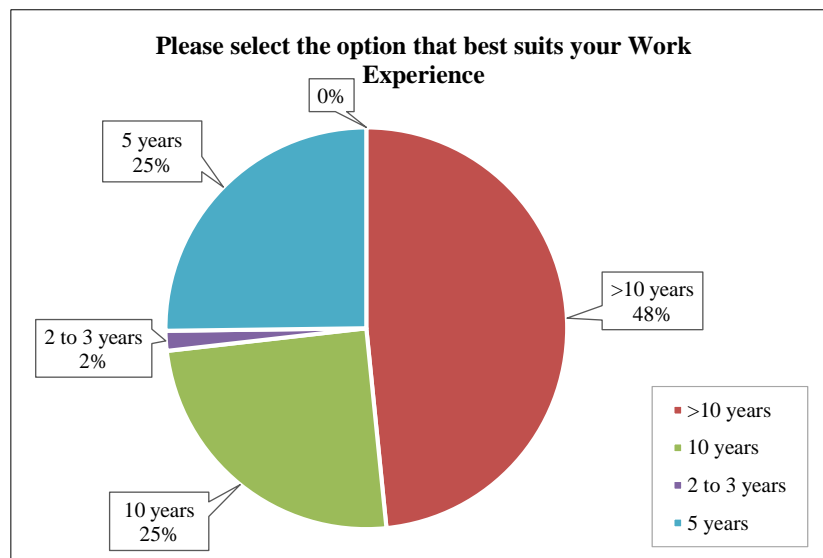**Figure 8.** The graph demonstrates that 74.8% of participants were mental health therapists and 25.2% were psychiatric consultants

Figure 9. The graph illustrates that 48.4% of participants had more than 10 years of experience, followed by 24.8% with 10 years, 1.6% with 2–3 years, and 25.2% with 5 years of experience in the field

4-2- Measurement Model Testing

The reliability and validity of the constructs used in the study were assessed using Cronbach's alpha, composite reliability (CR), and Average Variance Extracted (AVE), as presented in Table 2. All constructs demonstrated high internal consistency reliability, with Cronbach's alpha values ranging from 0.885 to 0.912, exceeding the recommended threshold of 0.7. The Composite Reliability (CR) values for all constructs were above 0.9, surpassing the suggested cut-off of 0.7, indicating strong construct reliability. Furthermore, the Average Variance Extracted (AVE) values for all constructs ranged from 0.630 to 0.721, exceeding the recommended threshold of 0.5, which suggests that the constructs capture a significant portion of the variance in their respective indicators. These results provide evidence of the reliability and convergent validity of the measurement model, supporting the suitability of the constructs for the subsequent structural equation modeling analysis.

Table 2. Reliability and Validity Assessment

Construct	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Digital Transformation (DT)	0.912	0.931	0.630
Opportunities	0.885	0.915	0.684
Challenges	0.897	0.924	0.708
AI Chat-bot Effectiveness	0.903	0.928	0.721
Mental Health Symptom Management	0.891	0.919	0.695

Table 3 presents the outer loadings for each indicator on their respective constructs. All outer loadings are above the recommended threshold of 0.7, indicating that the indicators are reliable measures of their respective constructs.

Table 3. Outer Loadings

Construct	Indicator	Outer Loading
Digital Transformation (DT)	DT1	0.823
	DT2	0.795
	DT3	0.847
	DT4	0.885
	DT5	0.748
	DT6	0.756
	DT7	0.718
	DT8	0.811
Opportunities	OPP1	0.847
	OPP2	0.833
	OPP3	0.784
	OPP4	0.857
	OPP5	0.796
Challenges	CHA1	0.865
	CHA2	0.839
	CHA3	0.798
	CHA4	0.741
	CHA5	0.822
AI Chat-bot Effectiveness	ACE1	0.873
	ACE2	0.852
	ACE3	0.792
	ACE4	0.821
	ACE5	0.818
Mental Health Symptom Management	MHSM1	0.841
	MHSM2	0.856
	MHSM3	0.783
	MHSM4	0.832
	MHSM5	0.804

Besides, the Fornell-Larcker criterion was assessed to evaluate the discriminant validity of the constructs. The square root of each construct's AVE (shown in bold on the diagonal) is greater than its correlations with other constructs, demonstrating satisfactory discriminant validity. The results of Fornell-Larcker test are summarized in Table 4.

Table 4. Fornell-Larcker test results

	DT	OPP	CHA	ACE	MHSM
Digital Transformation (DT)	*0.794*				
Opportunities (OPP)	0.612	*0.827*			
Challenges (CHA)	-0.487	-0.395	*0.841*		
AI Chat-bot Effectiveness (ACE)	0.583	0.625	-0.426	*0.849*	
Mental Health Symptom Management	0.551	0.594	-0.408	0.637	0.834

4-3- Hypothesis Testing

To assess the structural model and test the proposed hypotheses, we examined the path coefficients, t-values, p-values, coefficient of determination (R^2), effect size (f^2), and predictive relevance (Q^2). The significance of the path coefficients was determined using a bootstrapping procedure with 5,000 subsamples.

Table 5 presents the results of the hypothesis testing, including the path coefficients (β), t-values, p-values, and the conclusion for each hypothesis. The results of the hypothesis testing provide strong support for the proposed relationships in the conceptual model. The path coefficients, t-values, and p-values indicate that all five hypotheses are supported, confirming the significant impact of Digital Transformation (DT) on Opportunities and Challenges, the influence of Opportunities on AI Chat-bot Effectiveness, the effect of AI Chat-bot Effectiveness on Mental Health Symptom Management, and the mediating role of Challenges.

Table 5. Hypothesis Testing Results

Hypothesis	Path	Path Coefficient (β)	t-value	p-value	Conclusion
H1	Digital Transformation (DT) → Opportunities	0.612	12.749	0.000	Supported
H2	Digital Transformation (DT) → Challenges	-0.487	9.536	0.000	Supported
H3	Opportunities → AI Chat-bot Effectiveness	0.625	13.215	0.000	Supported
H4	AI Chat-bot Effectiveness → Mental Health Symptom Management	0.637	13.592	0.000	Supported
H5	Challenges → AI Chat-bot Effectiveness → Mental Health Symptom Management (Mediation)	-0.137 [a]	5.284	0.000	Supported

[a] Indirect effect

Hypothesis 1 (H1) and Hypothesis 2 (H2) examine the impact of Digital Transformation (DT) on Opportunities and Challenges, respectively. The results reveal that DT has a strong positive influence on Opportunities (β = 0.612, $p < 0.001$), suggesting that the adoption of digital technologies, infrastructure upgrades, and organizational readiness for digital transformation significantly enhance opportunities for improving mental healthcare services. However, DT has a significant negative impact on Challenges (β = -0.487, $p < 0.001$), indicating that digital transformation efforts can help mitigate the challenges associated with implementing digital technologies in mental healthcare settings, such as acceptability, affordability, and privacy concerns.

Hypothesis 3 (H3) and Hypothesis 4 (H4) investigate the relationships among opportunities, AI Chat-bot Effectiveness, and Mental Health Symptom Management. The results show that Opportunities have a strong positive influence on AI Chat-bot Effectiveness (β = 0.625, $p < 0.001$), implying that the opportunities created by digital transformation, such as improved access, convenience, and personalization, significantly enhance the effectiveness of AI chat-bots in delivering mental health services. Furthermore, AI Chat-bot Effectiveness has a significant positive impact on Mental Health Symptom Management (β = 0.637, $p < 0.001$), suggesting that the effective use of AI chat-bots can lead to improved management of mental health symptoms, such as reduced anxiety, depression, and stress.

Hypothesis 5 (H5) examines the mediating role of Challenges in the relationship between AI Chat-bot Effectiveness and Mental Health Symptom Management. The results demonstrate a significant indirect effect of Challenges on Mental Health Symptom Management through AI Chat-bot Effectiveness (β = -0.137, $p < 0.001$). This finding indicates that the challenges associated with digital transformation, such as privacy concerns and interoperability issues, can partially mediate the relationship between AI Chat-bot Effectiveness and Mental Health Symptom Management. In other words, while AI chat-bots can effectively support mental health symptom management, the presence of challenges can hinder their impact to some extent. This highlights the importance of addressing these challenges to maximize the benefits of AI chat-bots in mental healthcare.

Table 6 presents the R^2, f^2, and Q^2 values for the endogenous constructs. The R^2 values indicate that the model explains 37.5% of the variance in Opportunities, 23.7% in Challenges, 42.6% in AI Chat-bot Effectiveness, and 40.6% in Mental Health Symptom Management. The f^2 values suggest that Digital Transformation has a large effect on Opportunities ($f^2 = 0.600$) and a medium effect on Challenges ($f^2 = 0.311$). Opportunities have a large effect on AI Chat-bot Effectiveness ($f^2 = 0.639$), whereas Challenges have a small effect on AI Chat-bot Effectiveness ($f^2 = 0.105$). AI Chat-bot Effectiveness has a large effect on Mental Health Symptom Management ($f^2 = 0.683$). The Q^2 values for all endogenous constructs are above zero, indicating the model's predictive relevance.

Table 6. R^2, f^2, and Q^2 Values

Construct	R^2	f^2 (DT)	f^2 (Opportunities)	f^2 (Challenges)	f^2 (ACE)	Q^2
Opportunities	0.375	0.600	-	-	-	0.247
Challenges	0.237	0.311	-	-	-	0.158
AI Chat-bot Effectiveness	0.426	-	0.639	0.105	-	0.294
Mental Health Symptom Management	0.406	-	-	-	0.683	0.271

5- Discussion

This study aimed to investigate the impact of digital transformation on mental healthcare, focusing on the opportunities and challenges it presents, and the role of AI chat-bots in mental health symptom management. The research questions examined the relationships among digital transformation, opportunities, challenges, AI chat-bot effectiveness, and mental health symptom management. The main findings of the study support the proposed hypotheses, highlighting the significant influence of digital transformation on opportunities and challenges, the impact of opportunities on AI chat-bot effectiveness, and the role of AI chat-bots in mental health symptom management.

The findings support Hypothesis 1, which posits that digital transformation positively influences opportunities in mental healthcare. This result aligns with previous research that highlighted the potential of digital technologies to enhance access, convenience, and engagement in mental health services [4, 39]. The novelty of this study lies in its comprehensive examination of the specific opportunities created by digital transformation, such as improved accessibility through mobile applications and internet-based interventions, overcoming economic and geographical barriers, and the effectiveness of blended face-to-face and web-based interventions.

Hypothesis 2, which states that digital transformation poses significant challenges for mental healthcare organizations, was also supported by the findings. This result is consistent with the existing literature that has identified various barriers to the adoption and implementation of digital technologies in mental healthcare, such as acceptability, affordability, privacy concerns, and interoperability issues [5, 21]. The current study contributes to the understanding of these challenges by examining their specific impact on mental healthcare organizations and their potential to hinder the effective use of digital technologies.

The findings support Hypothesis 3, which proposes that opportunities presented by digital transformation positively influence the effectiveness of AI chat-bots in delivering mental health services. This result extends previous research on the potential of AI chat-bots to provide accessible, convenient, and personalized mental health support [6, 28]. The novelty of this study lies in its examination of the specific opportunities that enhance AI chat-bot effectiveness, such as the availability of large datasets and advanced analytics, and the ability to provide 24/7 support and reduce the stigma associated with seeking help.

Hypothesis 4, which stated that the effectiveness of AI chat-bots in delivering mental health services positively influences mental health symptom management, was supported by the findings. This result is consistent with previous research that has demonstrated the efficacy of AI chat-bots in reducing the symptoms of depression, anxiety, and stress [7, 33]. The current study contributes to the understanding of the mechanisms through which AI chat-bots support mental health symptom management, such as providing evidence-based interventions, offering personalized and empathetic support, and promoting treatment adherence.

The findings support Hypothesis 5, which proposes that challenges associated with digital transformation mediate the relationship between AI chat-bot effectiveness and mental health symptom management. This result extends previous research by highlighting the complex interplay between digital transformation challenges and the impact of AI chat-bots on mental health outcomes [31, 40]. The novelty of this study lies in its examination of specific challenges that can hinder the effectiveness of AI chat-bots, such as privacy concerns, lack of trust, and the need for culturally sensitive and adaptable interventions.

5-1- Theoretical Contributions

This study makes several important theoretical contributions to the field of digital mental healthcare. First, it extends the existing literature by providing a comprehensive framework that integrates the concepts of digital transformation, opportunities, challenges, AI chat-bot effectiveness, and mental health symptom management. By examining the relationships between these variables, this study offers a holistic understanding of how digital transformation impacts mental healthcare delivery and outcomes.

Second, this study contributes to the theoretical understanding of digital transformation in mental healthcare by identifying and empirically testing the specific opportunities and challenges it presents. While previous research has discussed the potential benefits and barriers of digital technologies in mental health services [4, 5], this study provides a more nuanced and contextualized understanding of these factors grounded in the perspectives of mental health professionals.

Third, this study advances the knowledge on the role of AI chat-bots in mental healthcare by examining their effectiveness in the context of digital transformation. By investigating how the opportunities and challenges associated with digital transformation influence the effectiveness of AI chat-bots, this study offers new insights into the factors that facilitate or hinder the successful implementation and adoption of these technologies in mental health services.

Fourth, this study contributes to the theoretical understanding of mental health symptom management by examining the impact of AI chat-bots on this outcome. While previous research has demonstrated the efficacy of AI chat-bots in reducing symptoms of depression, anxiety, and stress [6, 7], this study extends these findings by exploring the mechanisms through which AI chat-bots support mental health symptom management, such as providing personalized and empathetic support and promoting treatment adherence.

Finally, this study introduces a novel theoretical perspective by examining the mediating role of challenges in the relationship between AI chat-bot effectiveness and mental health symptom management. By highlighting the complex interplay between digital transformation challenges and the impact of AI chat-bots on mental health outcomes, this study offers a more nuanced understanding of the factors that influence the success of digital mental health interventions.

5-2- Practical Implications

The findings of this study have important practical implications for mental healthcare providers, policymakers, and technology developers involved in the implementation and advancement of digital mental health interventions. For mental healthcare providers, this study highlights the potential of digital transformation to enhance the delivery of mental health services. By leveraging the opportunities presented by digital technologies, such as improved accessibility, convenience, and engagement, providers can expand their reach and offer more flexible and personalized care to their clients. However, the study also underscores the importance of addressing the challenges associated with digital transformation, such as privacy concerns, interoperability issues, and the need for culturally sensitive interventions. Mental healthcare providers should prioritize the development of strategies to mitigate these challenges and ensure the effective and ethical use of digital technologies in their practice.

Policymakers can use the findings of this study to inform the development of guidelines and regulations for the use of digital technologies in mental healthcare. This study emphasizes the need for policies that promote the responsible and equitable adoption of digital mental health interventions while also protecting the privacy and security of sensitive patient data. Policymakers should collaborate with mental healthcare providers, technology developers, and other stakeholders to establish clear standards and best practices for the design, implementation, and evaluation of digital mental health interventions.

For technology developers, this study provides valuable insights into the factors that influence the effectiveness and adoption of AI chat-bots in mental healthcare. The findings highlight the importance of designing AI chat-bots that are not only technologically advanced but also culturally sensitive, empathetic, and able to establish trust with users [41]. Technology developers should work closely with mental healthcare providers and patients to ensure that AI chat-bots are tailored to the specific needs and preferences of different user groups and integrated seamlessly into existing mental health service systems [42].

Furthermore, the study emphasizes the importance of ongoing training and support for mental healthcare providers to effectively use and integrate digital technologies into their practice. Mental healthcare organizations should invest in professional development programs that equip providers with the knowledge and skills necessary to leverage digital tools and navigate the challenges associated with digital transformation.

Finally, this study highlights the need for continued research and evaluation of digital mental health interventions. Mental healthcare providers, policymakers, and technology developers should prioritize the collection and analysis of data on the effectiveness, acceptability, and sustainability of digital mental health interventions in real-world settings. This evidence-based approach will help identify best practices, refine existing interventions, and guide the development of new and innovative digital solutions for mental health care.

5-3- Limitations and Future Research Recommendations

While this study makes significant contributions to the understanding of digital transformation in mental healthcare and the role of AI chat-bots in mental health symptom management, it is important to acknowledge its limitations and provide recommendations for future research.

One limitation of this study is its cross-sectional design, which prevents the establishment of causal relationships between the variables examined. Future research should employ longitudinal designs to investigate the long-term effects of digital transformation and AI chat-bot interventions on mental health outcomes. This approach would provide valuable insights into the sustainability and effectiveness of these interventions over time and help identify potential barriers to long-term adoption and engagement.

Another limitation is the reliance on self-reported data from mental healthcare professionals. While the perspectives of these professionals are valuable, future research should also incorporate the experiences and opinions of patients and other stakeholders, such as policymakers and technology developers. This multi-informant approach would provide a more comprehensive understanding of the opportunities, challenges, and impacts of digital transformation in mental healthcare.

The study sample, although diverse, may not be representative of all mental healthcare professionals. Future research should recruit larger and more diverse samples, including professionals from different geographical regions, cultural backgrounds, and mental health disciplines. This would enhance the generalizability of the findings and provide a more nuanced understanding of the factors influencing the adoption and effectiveness of digital mental health interventions in various contexts.

This study focused on a specific type of digital technology, namely AI chat-bots. While these chat-bots have shown promise in mental health symptom management, future research should explore the effectiveness and challenges associated with other digital mental health interventions, such as mobile app, virtual reality, and telehealth platforms. Comparative studies examining the relative advantages and disadvantages of different digital interventions would help inform the development and implementation of tailored and effective digital mental health solutions.

Finally, future research should focus on developing and evaluating strategies to address the challenges identified in this study, such as privacy concerns, interoperability issues, and the need for culturally sensitive interventions. Collaborative research involving mental healthcare providers, technology developers, and policymakers could lead to the development of innovative solutions and best practices for overcoming these challenges and promoting the effective and equitable adoption of digital mental health interventions.

6- Conclusion

This study provides a comprehensive examination of the impact of digital transformation on mental healthcare, focusing on the opportunities and challenges it presents, and the role of AI chat-bots in mental health symptom management. The findings support the proposed hypotheses, highlighting the significant influence of digital transformation on opportunities and challenges, the impact of opportunities on AI chat-bot effectiveness, and the role of AI chat-bots in mental health symptom management.

This study makes significant theoretical contributions to the field of digital mental healthcare by providing a comprehensive framework, identifying specific opportunities and challenges, examining the effectiveness of AI chat-bots, exploring the mechanisms of mental health symptom management, and introducing a novel perspective on the mediating role of challenges. These contributions advance the understanding of digital transformation in mental healthcare and offer valuable insights for researchers, practitioners, and policymakers.

The practical implications of this study are far-reaching and emphasize the need for a collaborative and multidisciplinary approach to the implementation and advancement of digital mental health interventions. Mental healthcare providers, policymakers, and technology developers should leverage the opportunities presented by digital transformation, address the challenges, and prioritize the needs and preferences of patients and providers to harness the power of digital technologies and improve mental health outcomes.

Despite its limitations, such as the cross-sectional design and reliance on self-reported data from mental healthcare professionals, this study provides a solid foundation for future research in the field of digital mental healthcare. Future studies should build upon these findings by employing longitudinal designs, incorporating diverse perspectives, exploring other digital interventions, addressing ethical considerations, and developing strategies to overcome challenges.

This study underscores the transformative potential of digital technologies in mental healthcare and the crucial role of AI chat-bots in mental health symptom management. As the field of digital mental healthcare continues to evolve, it is essential for researchers, practitioners, and policymakers to collaborate and innovate to fully realize the benefits of digital transformation and AI chat-bots in improving mental health outcomes and transforming the delivery of mental healthcare services. By embracing opportunities, addressing challenges, and prioritizing the needs of patients and providers, we can harness the power of digital technologies to create a more accessible, effective, and equitable mental healthcare system.

7- Declarations

7-1- Author Contributions

Conceptualization, D.D. and Z.G.; methodology, Z.G. and M.E.K.; software, E.K.; validation, D.D. and N.G.; formal analysis, E.K.; investigation D.D. and Z.G.; resources, D.D. and N.G.; data curation, E.K.; writing—original draft preparation, D.D. and Z.G.; writing—review and editing, M.E.K. and A.P.; visualization, E.K.; supervision, Z.G.; project administration, D.D. and Z.G. All authors have read and agreed to the published version of the manuscript.

7-2- Data Availability Statement

The data presented in this study are available in the article.

7-3- Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

7-4- Institutional Review Board Statement

Not applicable.

7-5- Informed Consent Statement

Because the study included human participants, written informed consent was signed from individual participants before taking part in the research. The consent contained all necessary knowledge and research background and ensured that the participants read all the information as participation in the research was voluntary. However, this consent also showed participants' qualifications such that all participants were mental health professionals who were therapists and psychiatrists. The consent provided a proper disclaimer to participants about the risks over benefit ratios and was also reviewed by the ethical board during the evaluation of the research protocol.

7-6- Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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Appendix I: Questionnaire

Dear Participant,

Welcome your participation in this study, which aims to determine the mediating role of Artificial intelligence (AI)-based chat-bots amidst rapid digital transformation and challenges in mental healthcare (MHC) settings. An AI-powered chat-bot is an interesting advancement of digitalization that entails pre-trained data and can generate responses to users' input. For mental healthcare, these chat-bots are substantiated as positive conversational agents that provide an experience of human-like dialogue exchange and work as therapeutic agents. These chat-bots are highly anticipated for reducing mental health symptoms and disparities due to their flexibility and wider accessibility.

This research seeks to collect expert knowledge to determine the efficacy of AI chat-bots for mental health symptom management. In this regard, your views can add value to the knowledge and practice of the research area. Your participation is voluntary in the research. Also, it is informed that your identity will be anonymous and private and only relevant responses will be used to achieve the purpose of the study. Thus, upon participation agreement, this study will take only 10 to 15 minutes to respond to the 35 questionnaire items divided into Part A, Part B, Part C, and Part D.

Thank you for your time and cooperation in the study.

Part A: Demographic Information

Please select the option that best describes your Gender

- Male
- Female
- Prefer Not to Say

Please select the option that best describes your Age

- 20 to 30 years
- 31 – 35 years
- 36 – 45 years
- >45 years

Please select your Region

- Russia
- Indonesia
- South Korea

Please select the option that best suits your position

- Therapist
- Psychiatry consultant

Please select the option that best suits your Work Experience

- 2 to 3 years
- 5 years
- 10 years
- >10 years

Likert Scale Rating (Strongly disagree = 1; Agree = 2; Neutral = 3; Disagree = 2; Strongly Disagree = 1)

Codes	Digital Transformation	SD 1	D 2	N 3	A 4	SA 5
	Digital Transformation					
DT1	The mental healthcare sector has adopted digital technologies effectively.					
DT2	The mental healthcare sector has made necessary infrastructure upgrades for digital mental health services.					
DT3	There are policy changes supporting digital transformation in mental healthcare.					
DT4	Mental healthcare organizations are ready for digital transformation in their services.					
DT5	There is a significant level of investment in digital mental health solutions.					
DT6	Digital tools and platforms for mental health support are widely available.					
DT7	Mental healthcare professionals have high digital literacy.					
DT8	Digital technologies are well-integrated into existing mental healthcare systems.					
	Opportunities					
OPP1	Digital transformation with smartphone and mobile app interventions improved the convenience and engagement of mental health service users.					
OPP2	Internet-based cognitive behavioral therapy (CBT) has overcome economic and geographical barriers.					
OPP3	Therapists can interact with clients in their favorable environments, such as home or others, to conduct therapeutic exercises, which reduces the barriers of time, cost, and ethics.					
OPP4	Digital transformation has facilitated blending face-to-face sessions with web-based interventions to produce effective patient outcomes.					
OPP5	Technology has been integrated into almost all services like rehabilitation care, psychiatric counseling in virtual clinics, other telehealth services, and screening and diagnosis.					
	Challenges					
CHA1	Digital integration into mental healthcare (MHC) services faces problems in acceptability and affordability.					
CHA2	Therapists in virtual clinics are still not able to address wide mental health disparities among patients.					
CHA3	Anxiety and depression significantly vary across different racial and ethnic minorities, which is a big challenge for digital transformation in MHC.					
CHA4	Virtual clinic data and electronic patient data are vulnerable to privacy and security threats.					
CHA5	Interoperability and data sharing problems between different mental health service systems are major challenges.					
	AI Chat-bot Effectiveness					
ACE1	AI chat-bots can perform effective screening and diagnosis through questioning and answering sessions such as for stress, anxiety, and depression.					
ACE2	The chat-bot's voice assistance options allow them to understand the tone and emotions of stressed individual's conversations and make effective decisions for their mental health.					
ACE3	Chat-bots can also perform triaging understanding which patient should be treated first in terms of the severity of their symptoms.					
ACE4	The triaging function of chat-bots can help provide significant referrals for mental health service users who must seek immediate therapist care.					
ACE5	The employed NLP in chat-bots can create a human-like conversational experience which provides satisfaction and care.					
	Mental Health Symptom Management					
MHSM1	The different types of chat-bots especially for emotional and supportive services can understand the needs of different service users, understand their symptoms, and give effective responses.					
MHSM2	The chat-bots' empathetic responses can help reduce the immediate suicidal thoughts among mentally disturbed patients.					
MHSM3	The chat-bots' functional efficacy makes them potentially significant for providing therapies like CBT, dialectical therapy, and self-guided strategies without the assistance of a real therapist.					
MHSM4	Chat-bots are perceived as virtual therapists, highly trained by expert therapists to provide consultation and counseling for patients.					
MHSM5	Chat-bots can also promote a sense of independence among users where its self-guided strategies can promote both mental and behavioral changes among mental health service users.					

Table A-1. Mean and standard deviation for each item

Codes	Items	Mean	Std. Deviation
	Digital Transformation		
DT1	The mental healthcare sector has adopted digital technologies effectively.	4.09	0.986
DT2	The mental healthcare sector has made necessary infrastructure upgrades for digital mental health services.	4.20	1.060
DT3	There are policy changes supporting digital transformation in mental healthcare.	4.14	1.028
DT4	Mental healthcare organizations are ready for digital transformation in their services.	4.31	0.980
DT5	There is a significant level of investment in digital mental health solutions.	4.16	0.789
DT6	Digital tools and platforms for mental health support are widely available.	4.48	0.832
DT7	Mental healthcare professionals have high digital literacy.	4.38	0.962
DT8	Digital technologies are well-integrated into existing mental healthcare systems.	4.26	0.892
	Opportunities		
OPP1	Digital transformation with smartphone and mobile app interventions improved the convenience and engagement of mental health service users.	4.27	0.709
OPP2	Internet-based cognitive behavioral therapy (CBT) has overcome economic and geographical barriers.	4.29	0.785
OPP3	Therapists can interact with clients in their favorable environments, such as home or others, to conduct therapeutic exercises, which reduces the barriers of time, cost, and ethics.	4.32	0.914
OPP4	Digital transformation has facilitated blending face-to-face sessions with web-based interventions to produce effective patient outcomes.	4.22	0.975
OPP5	Technology has been integrated into almost all services like rehabilitation care, psychiatric counseling in virtual clinics, other telehealth services, and screening and diagnosis.	4.32	0.879
	Challenges		
CHA1	Digital integration into mental healthcare (MHC) services faces problems in acceptability and affordability.	4.26	0.913
CHA2	Therapists in virtual clinics are still not able to address wide mental health disparities among patients.	4.30	0.755
CHA3	Anxiety and depression significantly vary across different racial and ethnic minorities, which is a big challenge for digital transformation in MHC.	4.19	0.953
CHA4	Virtual clinic data and electronic patient data are vulnerable to privacy and security threats.	4.20	1.054
CHA5	Interoperability and data sharing problems between different mental health service systems are major challenges.	4.23	0.950
	AI Chat-bot Effectiveness		
ACE1	AI chat-bots can perform effective screening and diagnosis through questioning and answering sessions such as for stress, anxiety, and depression.	4.26	0.966
ACE2	The chat-bot's voice assistance options allow them to understand the tone and emotions of stressed individual's conversations and make effective decisions for their mental health.	4.29	0.892
ACE3	Chat-bots can also perform triaging understanding which patient should be treated first in terms of the severity of their symptoms.	4.40	0.841
ACE4	The triaging function of chat-bots can help provide significant referrals for mental health service users who must seek immediate therapist care.	4.25	0.881
ACE5	The employed NLP in chat-bots can create a human-like conversational experience which provides satisfaction and care.	4.35	1.003
	Mental Health Symptom Management		
MHSM1	The different types of chat-bots especially for emotional and supportive services can understand the needs of different service users, understand their symptoms, and give effective responses.	4.28	0.884
MHSM2	The chat-bots' empathetic responses can help reduce the immediate suicidal thoughts among mentally disturbed patients.	4.36	0.934
MHSM3	The chat-bots' functional efficacy makes them potentially significant for providing therapies like CBT, dialectical therapy, and self-guided strategies without the assistance of a real therapist.	3.75	0.890
MHSM4	Chat-bots are perceived as virtual therapists, highly trained by expert therapists to provide consultation and counseling for patients.	3.81	0.823
MHSM5	Chat-bots can also promote a sense of independence among users where its self-guided strategies can promote both mental and behavioral changes among mental health service users.	3.75	1.050