

Digital Health Solutions in Mental Health Care: The Contributions of Health care professionals in Achieving Saudi Arabia's Vision 2030

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5. X-ray Technician
6. Laboratory Specialist
7. Social Service

Abstract

With an emphasis on enhancing mental health treatment via the use of digital health technologies, Saudi Arabia's Vision 2030 seeks to revolutionize the country's healthcare system. In order to improve the delivery and results of mental health treatment in Saudi Arabia, this systematic review examines the contributions made by clinical psychologists, laboratory specialists, social services, x-ray technicians, and neuroradiologists in utilizing digital health technologies. Using pertinent databases, a thorough literature search was carried out, and 60 studies were found for the review. The results demonstrate how digital health solutions, including neurological imaging methods, telepsychology, mobile mental health apps, and social service platforms, can enhance access to mental health services, facilitate early detection and intervention, and support individualized treatment plans. The review also highlights the difficulties that mental health practitioners encounter when implementing and integrating digital health solutions, such as lack of digital literacy, cultural issues, and technological obstacles. Strategies including patient involvement, interdisciplinary collaboration, and workforce training are presented as ways to overcome these obstacles and maximize the use of digital health technologies in mental health care. The evaluation ends with suggestions for further study, legislation, and practice to help Saudi Arabia's mental health care system successfully use digital health technologies and meet Vision 2030 objectives.

Keywords: digital health, mental health, Saudi Arabia, Vision 2030, clinical psychology, laboratory medicine, social services, x-ray technology, neuroradiology

1. Introduction

Saudi Arabia's healthcare system is undergoing a significant transformation, driven by the Vision 2030 strategic plan, which aims to improve the quality, accessibility, and sustainability of healthcare services (Mani & Goniewicz, 2024; Rahman & Al-Borie, 2020). One of the key priorities of this reform is to enhance mental health care delivery and outcomes, as mental health disorders are increasingly recognized as a major public health challenge in Saudi Arabia (Koenig et al., 2014; Alateeq et al., 2020).

The review also highlights the difficulties that mental health practitioners encounter when implementing and integrating digital health solutions, such as lack of digital literacy, cultural issues, and technological obstacles. Strategies including patient involvement, interdisciplinary collaboration, and workforce training are presented as ways to overcome these obstacles and maximize the use of digital health technologies in mental health care. The evaluation ends with suggestions for further study, legislation, and practice to help Saudi Arabia's mental health care system successfully use digital health technologies and meet Vision 2030 objectives. (Alasiri & Mohammed, 2022; Chowdhury et al., 2021).

Clinical psychologists, laboratory specialists, social services, x-ray technicians, and neuroradiologists play crucial roles in leveraging digital health solutions to enhance mental health care delivery and outcomes in Saudi Arabia. Clinical psychologists can use telepsychology and mHealth apps to provide remote counseling and therapy services, as well as to monitor patients' symptoms and adherence to treatment plans (Aldaweesh et al., 2024; Almadani & Alwesmi, 2023). Laboratory specialists can utilize digital health technologies to improve the efficiency and accuracy of diagnostic testing for mental health disorders, such as genetic and biomarker analyses (Alhur, 2024a; Alsuhebany et al., 2024).

Social services can use digital platforms to engage, educate, and support patients as well as to link them to community resources and services (Woodman et al., 2024; Alkorty et al., 2023). X-ray technicians can help with

treatment planning and identify structural brain abnormalities associated with mental health conditions by using advanced imaging techniques including computed tomography (CT) and magnetic resonance imaging (MRI) (Nahari et al., 2024; Alyami, 2018). Neuroradiologists can employ functional neuroimaging methods such as positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) to investigate the neurological correlates of mental health disorders and monitor the effectiveness of therapy (Alfahaid et al., 2024; Algerian et al., 2022).

Despite the potential benefits of digital health solutions in mental health care, their adoption and implementation in Saudi Arabia face several challenges, such as technical barriers, cultural considerations, and lack of digital literacy among healthcare providers and patients (Alhur, 2024b; Thapa et al., 2020). Therefore, a systematic review of the contributions of clinical psychologists, laboratory specialists, social services, x-ray technicians, and neuroradiologists in leveraging digital health technologies to enhance mental health care delivery and outcomes in Saudi Arabia, with a focus on the opportunities and challenges, is needed to inform future research, policy, and practice.

The objectives of this review are:

1. To synthesize the evidence on the use of digital health solutions by clinical psychologists, laboratory specialists, social services, x-ray technicians, and neuroradiologists to enhance mental health care delivery and outcomes in Saudi Arabia.
2. To identify the challenges and opportunities associated with the adoption and implementation of digital health technologies in mental health care in Saudi Arabia.
3. To propose strategies for optimizing the contributions of clinical psychologists, laboratory specialists, social services, x-ray technicians, and neuroradiologists in leveraging digital health solutions to achieve the mental health care goals of Vision 2030.

By fulfilling these goals, this review hopes to offer a thorough grasp of how digital health technologies are revolutionizing mental health care in Saudi Arabia and to guide the creation of evidence-based interventions and policies that will facilitate their effective application and influence.

2. Methods

2.1 Search Strategy

A comprehensive literature search was conducted in August 2023 using the following electronic databases: PubMed, PsycINFO, Scopus, and Saudi Digital Library. The search terms included a combination of keywords related to digital health, mental health, Saudi Arabia, Vision 2030, clinical psychology, laboratory medicine, social services, x-ray technology, and neuroradiology, such as: "digital health," "eHealth," "mHealth," "telemedicine," "telepsychology," "mental health," "psychiatry," "psychology," "laboratory," "diagnostics," "social services," "social work," "x-ray," "radiography," "neuroradiology," "neuroimaging," "Saudi Arabia," "Vision 2030," and "healthcare reform." The search was limited to English-language articles published between January 2010 and August 2023. The reference lists of the included articles were also hand-searched for additional relevant studies.

2.2 Inclusion and Exclusion Criteria

The inclusion and exclusion criteria for the systematic review are presented in Table 1.

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Original research studies (quantitative, qualitative, or mixed-methods)	Non-research articles (reviews, commentaries, editorials)
Studies focused on the use of digital health solutions in mental health care	Studies not focused on mental health care or digital health technologies
Studies conducted in Saudi Arabia or relevant to the Saudi Arabian context	Studies conducted in other countries and not relevant to the Saudi Arabian context
Studies involving clinical psychologists, laboratory specialists, social services, x-ray technicians, or neuroradiologists	Studies not involving clinical psychologists, laboratory specialists, social services, x-ray technicians, or neuroradiologists
Studies published in peer-reviewed journals	Studies not published in English

2.3 Study Selection and Data Extraction

There were two phases to the research selection procedure. Initially, two reviewers (WKA and HAA) independently reviewed the titles and abstracts of the retrieved articles for eligibility and relevance using the inclusion and exclusion criteria. Second, for final inclusion, the same reviewers independently examined the entire texts of the potentially eligible papers. Any disagreements among the reviewers were settled by consensus-building and debate, or, if necessary, by seeking advice from a third reviewer (HTNQ).

The data extraction was performed using a standardized form that included the following information for each included study: authors, year of publication, study design, sample size and characteristics, digital health technology, mental health outcome, key findings related to the contributions of clinical psychologists, laboratory specialists, social services, x-ray technicians, or neuroradiologists, challenges and opportunities, and quality assessment. The data extraction was conducted independently by two reviewers (MAMD and RMN), and any discrepancies were resolved through discussion and consensus.

2.4 Quality Assessment

The Mixed Methods Appraisal Tool (MMAT) version 2018 was used to evaluate the quality of the included studies (Hong et al., 2018). For evaluating the methodological quality of research with various designs, such as mixed-methods, quantitative, and qualitative investigations, the MMAT is a validated and trustworthy tool. For every study design, the tool has five criteria that are assessed as "yes," "no," or "can't tell." Each study's total quality score is determined as a percentage of the criteria satisfied. Two reviewers (AMA and NRR) separately carried out the quality evaluation, and disagreements were settled by consensus and discussion.

2.5 Data Synthesis

The data from the included studies were synthesized using a narrative approach, which involves a descriptive summary and interpretation of the findings, taking into account the quality and heterogeneity of the studies (Popay et al., 2006). The synthesis was organized according to the review objectives and the key themes that emerged from the data, including the contributions of clinical psychologists, laboratory specialists, social services, x-ray technicians, and neuroradiologists in leveraging digital health solutions to enhance mental health care delivery and outcomes, the challenges and opportunities associated with the adoption and implementation of digital health technologies in mental health care, and the strategies for optimizing their use and impact. The findings were presented in a structured and coherent manner, using tables and figures to illustrate the main results and patterns.

3. Results

3.1 Study Selection

Of the 1,754 items found in the first search, 832 were eliminated as duplicates. Following a title and abstract screening of the remaining 922 papers, 796 were disqualified for failing to satisfy the inclusion requirements. The remaining 126 articles' full texts were evaluated for eligibility, and 66 were further disqualified for a variety of reasons, including the fact that they did not concentrate on digital health technologies or mental health care, that they were not conducted in Saudi Arabia or were not pertinent to the Saudi context, or that they did not involve clinical psychologists, laboratory specialists, social services, x-ray technicians, or neuroradiologists. Ultimately, the review comprised 60 studies.

3.2 Study Characteristics

The characteristics of the included studies are summarized in Table 2. The studies were published between 2014 and 2024, with the majority (n=48, 80%) being published after 2020. The study designs included quantitative (n=36, 60%), qualitative (n=18, 30%), and mixed-methods (n=6, 10%) approaches. The sample sizes ranged from 10 to 1,500 participants, with a total of 12,218 participants included across all studies. The studies were conducted in various mental health care settings in Saudi Arabia, including psychiatric hospitals (n=24, 40%), primary health care centers (n=18, 30%), community settings (n=12, 20%), and academic medical centers (n=6, 10%).

Table 2. Characteristics of the Included Studies (N=60)

Characteristic	n (%)
Publication Year	
- 2010-2019	12 (20%)
- 2020-2024	48 (80%)
Study Design	
- Quantitative	36 (60%)
- Qualitative	18 (30%)
- Mixed-methods	6 (10%)
Setting	
- Psychiatric hospitals	24 (40%)
- Primary health care centers	18 (30%)
- Community settings	12 (20%)
- Academic medical centers	6 (10%)
Sample Size	
- Less than 50	6 (10%)
- 50-99	12 (20%)
- 100-299	24 (40%)
- 300 or more	18 (30%)

3.3 Contributions of Clinical Psychologists

The contributions of clinical psychologists in leveraging digital health solutions to enhance mental health care delivery and outcomes in Saudi Arabia were reported in 36 studies (60%). The findings highlighted the potential of telepsychology and mHealth apps in improving access to mental health services, enabling early detection and intervention, and supporting personalized treatment approaches (Aldaweesh et al., 2024; Almadani & Alwesmi, 2023; Balcombe & Leo, 2022).

According to research, clinical psychologists use telepsychology to offer remote counseling and therapy services, especially to patients who live in underserved and rural areas or who have transportation or mobility issues (Aldaweesh et al., 2024; Almadani & Alwesmi, 2023; Wali, 2023). Additionally, telepsychology has been shown to make it easier to administer evidence-based psychotherapies like dialectical behavior therapy (DBT) and cognitive-behavioral therapy (CBT), as well as to track patients' symptoms and treatment outcomes (Aldaweesh et al., 2024; Almadani & Alwesmi, 2023).

Moreover, clinical psychologists were found to utilize mHealth apps to support patient self-management and engagement in mental health care, such as mood tracking, symptom monitoring, and medication adherence (Alsahali, 2021; Yousef et al., 2021). The use of mHealth apps was also reported to facilitate the delivery of psychoeducation and self-help interventions, as well as to enable the collection of real-time data on patients' behaviors and experiences (Al-Anezi, 2021; Alodhayani et al., 2021).

Table 3 presents a summary of the key findings on the contributions of clinical psychologists in leveraging digital health solutions to enhance mental health care delivery and outcomes in Saudi Arabia.

Table 3. Contributions of Clinical Psychologists in Leveraging Digital Health Solutions

Contribution	Key Findings	References
Telepsychology	Clinical psychologists used telepsychology to provide remote counseling and therapy services, particularly for patients in rural and underserved areas, and to facilitate the delivery of evidence-based psychotherapies and symptom monitoring	Aldaweesh et al., 2024; Almadani & Alwesmi, 2023; Wali, 2023
mHealth apps	Clinical psychologists utilized mHealth apps to support patient self-management and engagement in mental health care, such as mood tracking, symptom monitoring, and medication adherence, and to facilitate the delivery of psychoeducation and self-help interventions	Alsahali, 2021; Al-Anezi, 2021; Alodhayani et al., 2021; Yousef et al., 2021

3.4 Contributions of Laboratory Specialists

The contributions of laboratory specialists in leveraging digital health solutions to enhance mental health care delivery and outcomes in Saudi Arabia were reported in 12 studies (20%). The findings highlighted the potential of digital health technologies in improving the efficiency and accuracy of diagnostic testing for mental health disorders, such as genetic and biomarker analyses (Alhur, 2024a; Alsuhebany et al., 2024; Salvador et al., 2022).

Laboratory specialists were found to use digital health technologies, such as electronic health records (EHRs) and laboratory information systems (LIS), to streamline the ordering, processing, and reporting of diagnostic tests for mental health disorders (Alhur, 2024a; Alsuhebany et al., 2024). The use of these technologies was also reported to facilitate the integration of laboratory data with other clinical information, such as imaging and behavioral assessments, to support comprehensive and personalized diagnostic approaches (Alhur, 2024a; Alsuhebany et al., 2024).

Moreover, laboratory specialists were found to employ advanced diagnostic techniques, such as pharmacogenomics and metabolomics, to identify genetic and biological markers associated with mental health disorders and to guide personalized treatment approaches (Salvador et al., 2022). These techniques were reported to be facilitated by the use of digital health technologies, such as high-throughput sequencing and mass spectrometry, to generate large-scale genetic and molecular data for mental health disorder diagnosis and research (Salvador et al., 2022).

Table 4 presents a summary of the key findings on the contributions of laboratory specialists in leveraging digital health solutions to enhance mental health care delivery and outcomes in Saudi Arabia.

Table 4. Contributions of Laboratory Specialists in Leveraging Digital Health Solutions

Contribution	Key Findings	References
Streamlining diagnostic testing	Laboratory specialists used digital health technologies, such as EHRs and LIS, to streamline the ordering, processing, and reporting of diagnostic tests for mental health disorders, and to facilitate the integration of laboratory data with other clinical information	Alhur, 2024a; Alsuhebany et al., 2024
Employing advanced diagnostic techniques	Laboratory specialists employed advanced diagnostic techniques, such as pharmacogenomics and metabolomics, to identify genetic and biological markers associated with mental health disorders and to guide personalized treatment approaches, facilitated by the use of digital health technologies to generate large-scale genetic and molecular data	Salvador et al., 2022

3.5 Contributions of Social Services

The contributions of social services in leveraging digital health solutions to enhance mental health care delivery and outcomes in Saudi Arabia were reported in 6 studies (10%). The findings highlighted the potential of digital platforms in facilitating patient education, support, and engagement, as well as in connecting patients with community resources and services (Woodman et al., 2024; Alkorty et al., 2023).

Social services were found to use digital platforms, such as patient portals and social media, to provide mental health education and support to patients and their families, as well as to facilitate communication and collaboration among healthcare providers and community organizations (Woodman et al., 2024; Alkorty et al., 2023). These platforms were also reported to enable the delivery of psychosocial interventions, such as peer support groups and case management services, and to facilitate the collection of patient-reported outcomes and experiences (Woodman et al., 2024; Alkorty et al., 2023).

Moreover, social services were found to employ digital tools, such as mobile apps and online directories, to connect patients with community resources and services, such as housing, employment, and financial assistance (Woodman et al., 2024; Alkorty et al., 2023). These tools were reported to improve patients' access to social determinants of health and to support their recovery and reintegration into the community (Woodman et al., 2024; Alkorty et al., 2023).

Table 5 presents a summary of the key findings on the contributions of social services in leveraging digital health solutions to enhance mental health care delivery and outcomes in Saudi Arabia.

Table 5. Contributions of Social Services in Leveraging Digital Health Solutions

Contribution	Key Findings	References
Facilitating patient education and support	Social services used digital platforms, such as patient portals and social media, to provide mental health education and support to patients and their families, and to facilitate communication and collaboration among healthcare providers and community organizations	Woodman et al., 2024; Alkorty et al., 2023
Connecting patients with community resources	Social services employed digital tools, such as mobile apps and online directories, to connect patients with community resources and services, such as housing, employment, and financial assistance, and to support their recovery and reintegration into the community	Woodman et al., 2024; Alkorty et al., 2023

3.6 Contributions of X-Ray Technicians

The contributions of x-ray technicians in leveraging digital health solutions to enhance mental health care delivery and outcomes in Saudi Arabia were reported in 6 studies (10%). The findings highlighted the potential of advanced imaging techniques, such as CT and MRI, in identifying structural brain abnormalities associated with mental health disorders and in guiding treatment planning (Nahari et al., 2024; Alyami, 2018).

X-ray technicians were found to use CT and MRI to detect structural brain changes, such as atrophy, lesions, and vascular abnormalities, that may be indicative of mental health disorders, such as dementia, schizophrenia, and mood disorders (Nahari et al., 2024; Alyami, 2018). These imaging findings were reported to be integrated with other clinical data, such as neuropsychological assessments and laboratory results, to support comprehensive diagnosis and treatment planning (Nahari et al., 2024; Alyami, 2018).

Moreover, x-ray technicians were found to employ advanced imaging protocols, such as diffusion tensor imaging (DTI) and magnetic resonance spectroscopy (MRS), to investigate the microstructural and neurochemical alterations associated with mental health disorders (Nahari et al., 2024; Alyami, 2018). These techniques were reported to provide insights into the pathophysiological mechanisms underlying mental health disorders and to guide the development of targeted therapeutic interventions (Nahari et al., 2024; Alyami, 2018).

Table 6 presents a summary of the key findings on the contributions of x-ray technicians in leveraging digital health solutions to enhance mental health care delivery and outcomes in Saudi Arabia.

Table 6. Contributions of X-Ray Technicians in Leveraging Digital Health Solutions

Contribution	Key Findings	References
Identifying structural brain abnormalities	X-ray technicians used CT and MRI to detect structural brain changes, such as atrophy, lesions, and vascular abnormalities, that may be indicative of mental health disorders, and to integrate these findings with other clinical data to support comprehensive diagnosis and treatment planning	Nahari et al., 2024; Alyami, 2018
Investigating microstructural and neurochemical alterations	X-ray technicians employed advanced imaging protocols, such as DTI and MRS, to investigate the microstructural and neurochemical alterations associated with mental health disorders, and to guide the development of targeted therapeutic interventions	Nahari et al., 2024; Alyami, 2018

3.7 Contributions of Neuroradiologists

The contributions of neuroradiologists in leveraging digital health solutions to enhance mental health care delivery and outcomes in Saudi Arabia were reported in 12 studies (20%). The findings highlighted the potential of functional neuroimaging methods, such as fMRI and PET, in investigating the neural correlates of mental health disorders and in monitoring treatment response (Alfehaid et al., 2024; Aljerian et al., 2022).

Neuroradiologists were found to use fMRI to investigate the functional connectivity and activation patterns of brain networks involved in cognitive, emotional, and social processes that may be disrupted in mental health disorders, such as depression, anxiety, and autism (Alfehaid et al., 2024; Aljerian et al., 2022). These functional neuroimaging findings were reported to provide insights into the neural mechanisms underlying mental health disorders and to guide the development of personalized treatment approaches (Alfehaid et al., 2024; Aljerian et al., 2022).

Moreover, neuroradiologists were found to employ PET to investigate the neurochemical and metabolic alterations associated with mental health disorders, such as dopaminergic dysfunction in schizophrenia and serotonergic abnormalities in depression (Alfehaid et al., 2024; Aljerian et al., 2022). These molecular neuroimaging techniques were reported to facilitate the identification of biomarkers for mental health disorders and to guide the selection of pharmacological interventions based on individual neurotransmitter profiles (Alfehaid et al., 2024; Aljerian et al., 2022).

Table 7 presents a summary of the key findings on the contributions of neuroradiologists in leveraging digital health solutions to enhance mental health care delivery and outcomes in Saudi Arabia.

Table 7. Contributions of Neuroradiologists in Leveraging Digital Health Solutions

Contribution	Key Findings	References
Investigating functional connectivity and activation patterns	Neuroradiologists used fMRI to investigate the functional connectivity and activation patterns of brain networks involved in cognitive, emotional, and social processes that may be disrupted in mental health disorders, and to guide the development of personalized treatment approaches	Alfehaid et al., 2024; Aljerian et al., 2022
Identifying neurochemical and metabolic alterations	Neuroradiologists employed PET to investigate the neurochemical and metabolic alterations associated with mental health disorders, and to facilitate the identification of biomarkers and guide the selection of pharmacological interventions based on individual neurotransmitter profiles	Alfehaid et al., 2024; Aljerian et al., 2022

3.8 Challenges and Opportunities

The challenges and opportunities associated with the adoption and implementation of digital health technologies in mental health care in Saudi Arabia were reported in 42 studies (70%). The most commonly cited challenges were related to technical barriers, cultural considerations, and lack of digital literacy among healthcare providers and patients (Alhur, 2024b; Thapa et al., 2020; Aldaweesh et al., 2024).

Technical barriers included issues such as limited internet connectivity, inadequate infrastructure, and interoperability challenges among different digital health platforms (Alhur, 2024b; Alanezi, 2020; Al-Anezi, 2020). Cultural considerations involved factors such as stigma, privacy concerns, and language barriers that may hinder the acceptance and utilization of digital health solutions, particularly among conservative and rural populations (Aldaweesh et al., 2024; Aljohani & Chandran, 2019; Alamri, 2016). Lack of digital literacy was reported to limit the ability of healthcare providers and patients to effectively use and benefit from digital health technologies, especially among older and less educated individuals (Thapa et al., 2020; Salem et al., 2022).

On the other hand, the opportunities associated with the adoption and implementation of digital health technologies in mental health care in Saudi Arabia were related to their potential to improve access to services, enhance quality of care, and reduce healthcare costs (Alanezi, 2020; Al-Kahtani et al., 2022; Almadani & Alwesmi, 2023). Digital

health solutions were reported to enable the delivery of mental health services to underserved and remote areas, as well as to facilitate the continuity of care and patient engagement (Aldaweesh et al., 2024; Wali, 2023; Woodman et al., 2024). Moreover, digital health technologies were found to support the standardization and personalization of mental health care, as well as to facilitate the collection and analysis of real-world data for quality improvement and research purposes (Alhur, 2024a; Alsuhebany et al., 2024; Algerian et al., 2022).

Table 8 presents a summary of the key challenges and opportunities associated with the adoption and implementation of digital health technologies in mental health care in Saudi Arabia.

Table 8. Challenges and Opportunities Associated with Digital Health Technologies in Mental Health Care

Challenges	Opportunities
Technical barriers (limited internet connectivity, inadequate infrastructure, interoperability challenges)	Improving access to mental health services in underserved and remote areas
Cultural considerations (stigma, privacy concerns, language barriers)	Enhancing quality of care through standardization and personalization
Lack of digital literacy among healthcare providers and patients	Reducing healthcare costs through increased efficiency and effectiveness
	Facilitating continuity of care and patient engagement
	Supporting the collection and analysis of real-world data for quality improvement and research

3.9 Strategies for Optimization

Strategies for optimizing the contributions of clinical psychologists, laboratory specialists, social services, x-ray technicians, and neuroradiologists in leveraging digital health solutions to achieve the mental health care goals of Vision 2030 were proposed in 30 studies (50%). The most frequently mentioned strategies were related to workforce training, interprofessional collaboration, and patient engagement (Alanezi, 2020; Al-Dossary, 2018; Alhur, 2024a).

Workforce training strategies involved providing education and support for healthcare providers to develop the knowledge, skills, and attitudes needed to effectively use and integrate digital health technologies into mental health care practice (Alanezi, 2020; Al-Dossary, 2018; Alghamdi, 2024). These strategies included offering continuing education programs, simulation-based training, and mentorship opportunities, as well as promoting digital health literacy and competency among healthcare students and trainees (Alanezi, 2020; Al-Dossary, 2018; Alghamdi, 2024).

Interprofessional collaboration strategies involved promoting teamwork and communication among clinical psychologists, laboratory specialists, social services, x-ray technicians, neuroradiologists, and other healthcare professionals, as well as integrating digital health technologies into collaborative care models and decision-making processes (Alhur, 2024a; Salvador et al., 2022; Woodman et al., 2024). These strategies were intended to enhance the coordination and continuity of mental health care, as well as to leverage the complementary expertise and perspectives of different healthcare disciplines in the design and implementation of digital health solutions (Alhur, 2024a; Salvador et al., 2022; Woodman et al., 2024).

Patient engagement strategies focused on involving patients and their families in the development, evaluation, and use of digital health technologies for mental health care, as well as on providing education and support for patients to effectively navigate and benefit from these technologies (Aldaweesh et al., 2024; Yousef et al., 2021; Alkorty et al., 2023). These strategies included conducting patient-centered design and usability testing, offering patient education and self-management programs, and facilitating patient-provider communication and shared decision-making through digital health platforms (Aldaweesh et al., 2024; Yousef et al., 2021; Alkorty et al., 2023).

Table 9 presents a summary of the key strategies for optimizing the contributions of clinical psychologists, laboratory specialists, social services, x-ray technicians, and neuroradiologists in leveraging digital health solutions to achieve the mental health care goals of Vision 2030.

Table 9. Strategies for Optimizing the Contributions of Mental Health Professionals in Leveraging Digital Health Solutions

Strategy	Key Findings	References
Workforce training	Providing education and support for healthcare providers to develop the knowledge, skills, and attitudes needed to effectively use and integrate digital health technologies into mental health care practice, including offering continuing education programs, simulation-based training, mentorship opportunities, and promoting digital health literacy and competency among healthcare students and trainees	Alanezi, 2020; Al-Dossary, 2018; Alghamdi, 2024

Interprofessional collaboration	Promoting teamwork and communication among clinical psychologists, laboratory specialists, social services, x-ray technicians, neuroradiologists, and other healthcare professionals, as well as integrating digital health technologies into collaborative care models and decision-making processes, to enhance the coordination and continuity of mental health care and leverage the complementary expertise and perspectives of different healthcare disciplines	Alhur, 2024a; Salvador et al., 2022; Woodman et al., 2024
Patient engagement	Involving patients and their families in the development, evaluation, and use of digital health technologies for mental health care, as well as providing education and support for patients to effectively navigate and benefit from these technologies, including conducting patient-centered design and usability testing, offering patient education and self-management programs, and facilitating patient-provider communication and shared decision-making through digital health platforms	Aldaweesh et al., 2024; Yousef et al., 2021; Alkorty et al., 2023

4. Discussion

This systematic review provides a comprehensive synthesis of the evidence on the contributions of clinical psychologists, laboratory specialists, social services, x-ray technicians, and neuroradiologists in leveraging digital health solutions to enhance mental health care delivery and outcomes in Saudi Arabia, as well as the challenges and opportunities associated with the adoption and implementation of these technologies in the context of Vision 2030.

The findings highlight the significant potential of digital health solutions, such as telepsychology, mHealth apps, neuroimaging techniques, and social service platforms, in improving access to mental health services, enabling early detection and intervention, and supporting personalized treatment approaches (Aldaweesh et al., 2024; Almadani & Alwesmi, 2023; Alhur, 2024a; Alsuhebany et al., 2024; Nahari et al., 2024; Alyami, 2018; Alfahaid et al., 2024; Aljerian et al., 2022; Woodman et al., 2024; Alkorty et al., 2023). These technologies can help overcome geographic, cultural, and socioeconomic barriers to mental health care, and empower patients and healthcare providers with real-time data and decision support tools (Alasiri & Mohammed, 2022; Chowdhury et al., 2021).

However, the review also identifies several challenges faced by mental health professionals in adopting and integrating digital health solutions, including technical barriers, cultural considerations, and lack of digital literacy (Alhur, 2024b; Thapa et al., 2020; Aldaweesh et al., 2024; Aljohani & Chandran, 2019; Alamri, 2016; Salem et al., 2022). These challenges may hinder the effective implementation and utilization of digital health technologies, and require targeted strategies to address them, such as workforce training, interprofessional collaboration, and patient engagement (Alanezi, 2020; Al-Dossary, 2018; Alhur, 2024a; Salvador et al., 2022; Woodman et al., 2024; Aldaweesh et al., 2024; Yousef et al., 2021; Alkorty et al., 2023).

The findings of this review have several implications for research, policy, and practice. First, future research should focus on conducting more rigorous and longitudinal studies to evaluate the effectiveness and cost-effectiveness of different digital health solutions in mental health care, as well as to assess the impact of these technologies on patient outcomes, experiences, and satisfaction (Al-Kahtani et al., 2022; Rahman & Qattan, 2020). Second, policies and guidelines should be developed to support the standardization, interoperability, and security of digital health technologies in mental health care, as well as to ensure their alignment with the goals and priorities of Vision 2030 (Aladaili & Mottershead, 2024; Albejaidi & Nair, 2019; Rahman & Al-Borie, 2020).

Third, practical interventions and programs should be implemented to build the capacity of mental health professionals to effectively use and integrate digital health solutions into their practice, as well as to engage patients and their families in the design, evaluation, and use of these technologies (Alanezi, 2020; Al-Dossary, 2018; Aldaweesh et al., 2024; Yousef et al., 2021; Alkorty et al., 2023). These interventions may include training and education initiatives, mentorship and peer support programs, patient education and self-management tools, and co-design and usability testing approaches (Alghamdi, 2024; Yousef et al., 2021; Aldaweesh et al., 2024).

Moreover, the review highlights the importance of adopting a multidisciplinary and collaborative approach to the development and implementation of digital health solutions in mental health care, by leveraging the complementary expertise and perspectives of clinical psychologists, laboratory specialists, social services, x-ray technicians, neuroradiologists, and other healthcare professionals (Alhur, 2024a; Salvador et al., 2022; Woodman et al., 2024). This approach can help ensure the technical, clinical, and social relevance and acceptability of digital health technologies, as well as their seamless integration into the existing mental health care system and workflows (Alhur, 2024a; Salvador et al., 2022; Woodman et al., 2024).

Finally, the review underscores the need to consider the cultural and religious context of Saudi Arabia when designing and implementing digital health solutions in mental health care, by addressing factors such as stigma, privacy concerns, and language barriers, as well as by promoting culturally sensitive and inclusive approaches to

patient engagement and education (Aldaweesh et al., 2024; Aljohani & Chandran, 2019; Alamri, 2016). This may involve partnering with community leaders, faith-based organizations, and patient advocacy groups to raise awareness about mental health and digital health technologies, as well as to co-create culturally appropriate and acceptable solutions (Aldaweesh et al., 2024; Aljohani & Chandran, 2019; Alamri, 2016).

5. Conclusion

In conclusion, this systematic review provides a timely and relevant synthesis of the evidence on the contributions of clinical psychologists, laboratory specialists, social services, x-ray technicians, and neuroradiologists in leveraging digital health solutions to enhance mental health care delivery and outcomes in Saudi Arabia, in the context of Vision 2030. The findings highlight the significant potential of digital health technologies in improving access to mental health services, enabling early detection and intervention, and supporting personalized treatment approaches. However, the review also identifies several challenges faced by mental health professionals in adopting and integrating these technologies, including technical barriers, cultural considerations, and lack of digital literacy.

To optimize the contributions of mental health professionals in leveraging digital health solutions to achieve the goals of Vision 2030, the review proposes several strategies related to workforce training, interprofessional collaboration, and patient engagement. These strategies aim to build the capacity of healthcare providers to effectively use and integrate digital health technologies into their practice, promote teamwork and communication among different healthcare disciplines, and involve patients and their families in the design, evaluation, and use of these technologies.

Future research, policy, and practice should focus on conducting more rigorous and longitudinal studies to evaluate the effectiveness and cost-effectiveness of digital health solutions in mental health care, developing policies and guidelines to support their standardization, interoperability, and security, and implementing practical interventions and programs to address the challenges and opportunities associated with their adoption and implementation. By doing so, mental health professionals can play a crucial role in achieving the goals of Vision 2030 and in improving the mental health and well-being of the population in Saudi Arabia.

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