CAHIERS MAGELLANES-NS
Volume 06 Issue 2
2024

ISSN:1624-1940
DOI 10.6084/m9.figshare.2632599
http://magellanes.com/

DIGITAL TECHNOLOGY USE IN MENTAL HEALTH: CHALLENGES AND OPPORTUNITIES

Noor Alhuzali[1]
Dioso, Regidor III[2]
1. Alhuzali.phdscholar@lincoln.edu.my
2. duke@lincoln.edu.my (Associate Professor, Lincoln University College, Ss 6, Kelana Jaya, Petaling Jaya, Selangor, Malaysia)

Abstract

This study analysed the digital technologies in mental healthcare along with the challenges and opportunities. A total of 15 papers were selected using the topic itself as the search term. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram guideline was used in the selection process. Search terms were keyed in Google Scholar and PubMed as search engines. Of the 20 published articles reviewed, only 15 studies were used in this review. Online and mobile applications have been very useful in this regard, especially during the COVID-19 period. Greater focus with adequate support is necessary for intellectually disabled, socio-economically backward and refugee mental patients, as they face many barriers in accessing quality mental healthcare. Ethical, legal and regulatory aspects are important in all these respects. Future research may focus more on applications of artificial intelligence and machine learning methods as digital technologies for mental healthcare.
Key word: qualitative review, digital technology, mental health domain, COVID-19 period

Introduction

Many definitions exist for the term "digital technologies". Some definitions given in various sources are reproduced below.

Pullen (2009): A technology that relies on the use of microprocessors; hence, computers and applications that are dependent on computers such as the Internet, as well as other devices such as video cameras, and mobile devices such as phones and personal digital assistants.

Cohn (2024): Digital technology refers to the use of digital systems, tools, and devices that process, store, and transmit data in electronic form. It encompasses a wide range of technologies, including computers, smartphones, software applications, the internet, and emerging technologies such as artificial intelligence, machine learning, and blockchain.

Begi, et al. (2023): Electronic devices used to collect, process, analyse, transmit, receive and store information.

Thus, both technologies and devices together constitute digital technologies.

Digital applications in mental health include data collection, interventions, e-healthcare and telemedicine (Srivastava, et al., 2020). Aguilera (2015) added mhealth and online interventions to this list. Some barriers to its widespread use are slow dissemination, limited workforce, privacy issues, health insurance issues (mental healthcare gets lower rates of reimbursement), digital divide, slow research outputs, large volumes of data and interdisciplinary nature. Opportunities lie in developing

ISSN:1624-1940
DOI 10.6084/m9.figshare.2632599
http://magellanes.com/

new ways of using digital technologies with multidisciplinary collaborations and large-scale promotions of mobile healthcare as the use of mobile phones has spread fast without any income barriers.

Thus, digital technologies offer many benefits in mental healthcare. But these benefits involve challenges also. One way of addressing challenges is to create more opportunities in digital applications for mental healthcare. This issue is examined here with the help of a qualitative review of the literature. Thus, the research question for this review is-

What are the digital technologies used in mental healthcare? What are the opportunities which can be used to address the challenges to the benefits of digital technologies in mental healthcare?

Methodology & Results

Methodology

This study is a qualitative review aimed at investigating the challenges and opportunities associated with the use of digital technologies in mental healthcare. The research design was chosen to provide an in-depth, comprehensive understanding of the current landscape and identify gaps for future research.

To gather relevant literature, the key words "digital technologies in mental healthcare" was used as the primary search term keyed in search engines such as the Google Scholar and PubMed. The search was conducted within a specified time frame from 2009 to current to ensure that the most recent and relevant studies were included.

To be included in the review, papers needed to meet the following criteria: 1) published in English, 2) peer-reviewed journal articles, 3) directly related to the use of digital technologies in the context of mental health services, interventions, or support systems, and 4) empirical studies, systematic reviews, meta-analyses, and theoretical papers.

The initial search yielded 20 published articles. Following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram, the selection process involved several stages as shown in Figure 1.

The provided PRISMA guideline is a comprehensive representation of the article selection process employed in this review of digital technology focusing in the domains of mental health. This diagram delineates each step, starting from the identification of records through the final inclusion in qualitative synthesis, ensuring transparency and replicability in the review process.

Identification Phase:

In the initial identification phase, a total of 20 records were identified through a search on Google Scholar using the search term "digital technologies in mental healthcare." Notably, no additional records were identified through other sources. This indicates a focused and streamlined approach to source gathering, relying on a single, yet comprehensive academic database.

Screening Phase:

Following the identification, the next critical step was the screening phase. After removing duplicates, 18 records remained for further assessment. During the initial screening, 2 records were excluded. This exclusion was based on criteria set forth in the methodology section, ensuring that only relevant and high-quality articles were retained for deeper evaluation.

Eligibility Phase:

The eligibility phase involved a more thorough examination of the remaining 16 records. Full-text

ISSN:1624-1940
DOI 10.6084/m9.figshare.2632599
http://magellanes.com/

articles were assessed to confirm their relevance and suitability for the review. In this phase, 1 article was excluded because it was not published in English. This decision underscores the importance of language consistency to maintain uniformity in the review process, although it also highlights a potential language bias, as non-English studies were excluded.

Inclusion Phase:

Ultimately, 15 studies were included in the qualitative synthesis. This final step ensures that the selected articles meet all inclusion criteria and contribute valuable data to the review. The included studies form the foundation for the subsequent thematic analysis, where common themes and patterns in the use of digital technologies in mental health care are identified and discussed.

The extracted data were analysed using thematic analysis to identify common themes and patterns. This involved familiarization, coding, theme development, review and refinement. Table 1 shows the Coding, Theme Development, Review and Refinement

Table 1. Coding, Theme Development, Review and Refinement

Coding	Theme Development	Review and Refinement
Identified initial codes from the qualitative data, such as 'digital rehabilitation,' 'data privacy,' 'e-health,' etc.	Grouped related codes into broader themes like 'Innovative Rehabilitation Techniques,' 'Privacy and Ethical Considerations,' 'Access to Mental Health Services,' etc.	Refined themes by reviewing for consistency and relevance, ensuring that each theme accurately represents the underlying data and provides a comprehensive understanding of the topic.
Used a systematic approach to ensure all relevant data was coded accurately and comprehensively.	Developed detailed descriptions for each theme, highlighting key findings and their implications for digital mental health care.	Conducted a final review to ensure the themes align with the research questions and objectives, making necessary adjustments to improve clarity and coherence.
Applied coding to various aspects of the studies, including interventions, target populations, outcomes, and challenges.	Themes were iteratively refined through discussions and feedback from co-researchers, ensuring robustness and validity.	Ensured that the final themes were distinct and non-overlapping, providing a clear framework for the synthesis of the qualitative data.

To ensure the robustness of the included studies, each was appraised for methodological quality using a standardized checklist found in table 2, addressing elements such as study design, target population, data collection methods, and validity of findings. This assessment helped to weigh the influence of each

ISSN:1624-1940
DOI 10.6084/m9.figshare.2632599
http://magellanes.com/

study in the synthesis process.

In order to identify biases in the reviewed published articles, several steps were taken. Firstly, potential biases were considered by peer-review, which were typically subjected to rigorous scrutiny. However, this criterion still introduced biases as studies with negative or inconclusive results are less likely to be included in this review. Secondly, this study addressed the systematic application of inclusion criteria and the use of the PRISMA guideline to ensure a transparent and reproducible selection process. Thirdly, the appraisal of methodological quality was tabled with biases related to study design, sample size, and data collection methods, which were noted during the synthesis process.

After following this rigorous methodological framework, the findings were organized and discussed, highlighting both the positive implications and ongoing challenges of integrating digital technologies in mental health care.

ISSN:1624-1940
DOI 10.6084/m9.figshare.2632599
http://magellanes.com/

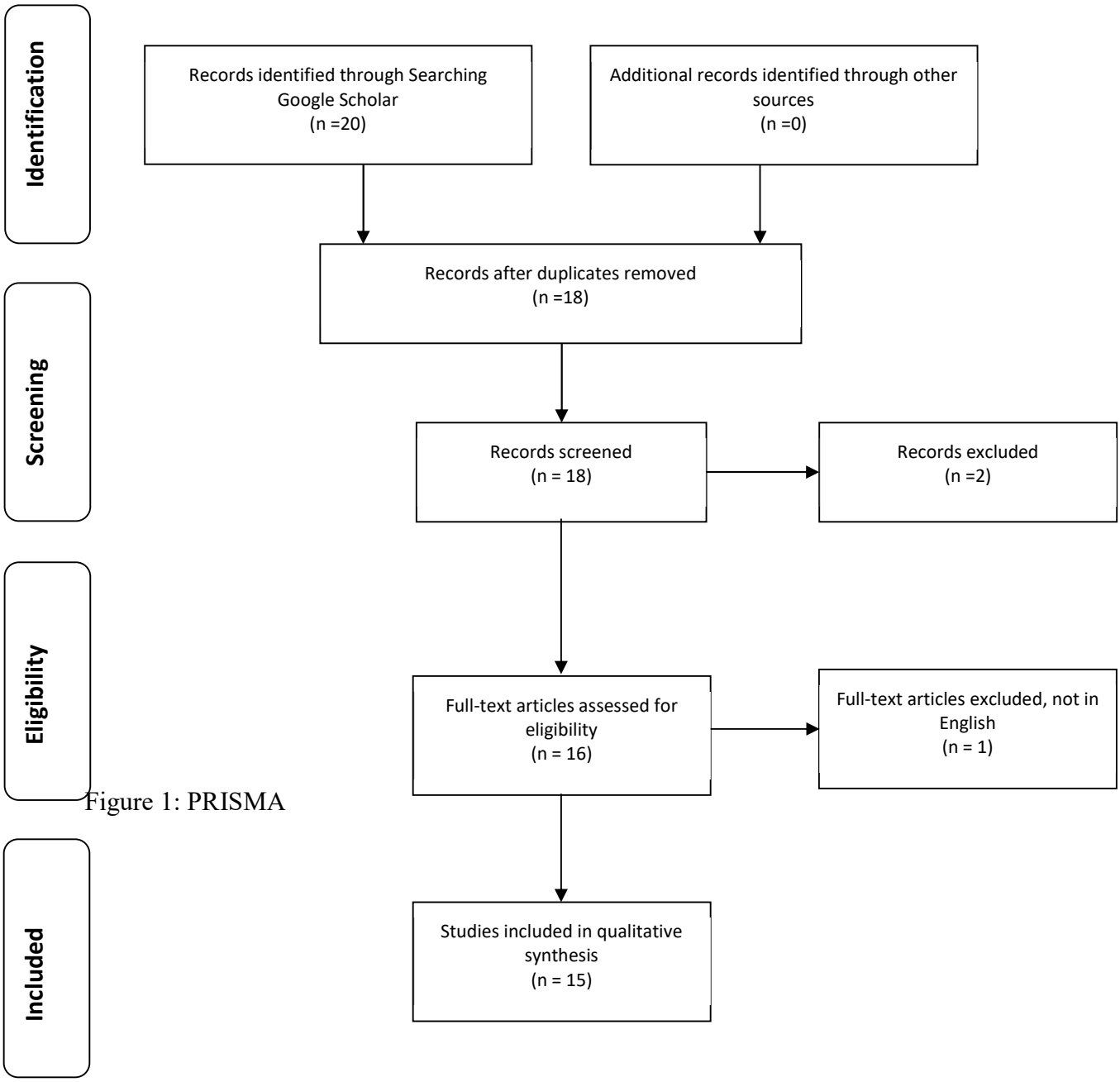

Figure 1: PRISMA

ISSN:1624-1940
DOI 10.6084/m9.figshare.2632599
http://magellanes.com/

Results

General mental healthcare

In the case of Schizophrenic patients, Lopes, et al. (2021) attempted to use digital technologies to design and develop innovative rehabilitation techniques focusing on mental health rehabilitation, and promotion of well-being and health from a holistic perspective.

In an editorial, Hollis, et al. (2015) highlighted the potential of digital technology to transform mental healthcare. New ways of digital technologies can be used to connect patients with services and health data. Online and mobile applications offer better access to information and services. This enhances early intervention and clinical management using real-time patient data. Some government policies act as drivers of digital applications of mental healthcare. E-mental healthcare is a culture change as it shifts from face-to-face care to online care that empowers patients for patient-centred care. This is reflected in m-health, e-health and telehealth. However, the demand for mental healthcare services is far beyond the supply of facilities and workforce. Challenges to data privacy and big data also exist.

Opportunity costs of not using digital technologies in mental healthcare can be tremendous. This is because using digital technologies can reduce medical errors significantly contributing to poor quality patient outcomes. The current methods of empowering mental patients through digital technologies are inadequate due to insufficient consideration of wider psychological and socioeconomic factors. These lead to the risk of missed opportunities for patient engagement. They may also lead to a misunderstanding of the role played by key bioethical principles in shaping healthcare delivery. The existence of different barriers to engagement for other mental health problems needs to be considered according to the situated nature of individual patients. The principles of ethics in the use of digital technologies for mental healthcare were proposed by (Burr & Morley, 2020). These were the correct level of patient autonomy, extended beneficence to patients and caregivers, standards of evidence for effective interventions, non-maleficence, justice and explicability.

The widespread utilisation of digital technologies within mental health services in the absence of adequate legal and regulatory frameworks could lead to various complications. Our understanding of the extent and nature of the transformations occurring in mental healthcare due to digital technologies is incomplete. Key issues revolving around the ethical, legal, and social implications at the intersection of digital technologies and existing mental healthcare practices include the types of technologies employed, the individuals utilising them, and the populations they target. Concerns regarding the use of digital technologies in healthcare encompass safeguarding essential rights such as dignity, liberty, equality, privacy, and protection against exploitation, along with upholding ethical principles like transparency, minimizing harm, and ensuring accountability. Additionally, there are social and political apprehensions regarding the potential consolidation of influence among a limited number of technologists, clinicians, researchers, and other stakeholders. Therefore, there is a growing necessity for collaborative technology development efforts. Challenges also encompass aspects of global cooperation, the possible diminishment of personal interactions in caregiving relationships, escalating demands on service providers to incorporate digital tools to reduce in-person engagement time, evolving concepts around personal mental health data, the danger of excessively promoting technology without robust evidence, and broader implications associated with the increasing involvement of clinical,

ISSN:1624-1940
DOI 10.6084/m9.figshare.2632599
http://magellanes.com/

governmental, and market forces in individuals' mental well-being (Gooding, 2019).

A narrative review was undertaken by Sheehan and Hassiotis (2017) to explore the opportunities and risks of digital technologies in mental healthcare especially concerning the people with intellectual disability who may be marginalised and socially excluded group. Intellectually disabled people experience high rates of mental illness, but they are excluded from the development and use of digital technologies for novel interventions. The barriers faced by intellectually disabled mental patients in using digital technologies can be overcome with appropriate support and adaptations. The very few papers available on this subject show the benefits of digital technology not only in enhancing mental health but their educational, vocational and leisure activities also.

Although mental health problems are higher among refugees, they face barriers to accessing care support. These barriers can be overcome by using digital technologies. After an examination of various factors, Goodman, et al. (2021) concluded that the development of more effective digital tools can occur through partnerships with refugee communities, prioritizing their involvement in designing digital interventions for mental health.

The inequitable distribution of mental health resources exacerbates the burden of mental illnesses within marginalized demographics, particularly in less economically developed nations. Digital technologies and online interventions have the potential to narrow the gap between the high occurrence of mental health conditions, the need for treatment, and the availability of mental health services, thus addressing disparities in mental health care. While numerous studies have shown the feasibility of internet-based interventions, research is scarce on their efficacy and cost-effectiveness, hindering the widespread adoption and expansion of such programs. Nonetheless, the increasing body of knowledge amassed in Chile could offer valuable guidance for implementing similar practices in other developing regions to support the mental well-being of underserved communities. These observations were made by Rojas, et al. (2019) based on a mini-narrative review.

The consensus report of a panel of international experts (Smith, et al., 2023) provides an overview of the use of digital technologies in mental health, discussing both challenges and opportunities. Various definitions of digital technologies are presented from different sources. The applications of digital technologies in mental health include data collection, interventions, e-healthcare, telemedicine, mhealth, and online interventions. Barriers to the widespread use of digital technologies in mental health include slow dissemination, limited workforce, privacy issues, health insurance concerns, the digital divide, slow research outputs, large data volumes, and the interdisciplinary nature of mental healthcare. Opportunities exist in developing new ways of utilizing digital technologies through multidisciplinary collaborations and promoting mobile healthcare. The text also explores the integration of digital technologies in mental healthcare during the COVID-19 pandemic. It highlights how digital technologies such as telehealth, web-based interventions, mobile platforms, chatbots, and artificial intelligence have been utilized to address mental health challenges exacerbated by the pandemic. Investments in research, training, regulatory frameworks, and personalized digital technologies are emphasized as crucial for enhancing mental healthcare quality and accessibility using digital tools. Overall, the discussions underscored the potential benefits of digital technologies in mental health while acknowledging challenges related to ethics, regulation, data privacy, workforce training, and the need

ISSN:1624-1940
DOI 10.6084/m9.figshare.2632599
http://magellanes.com/

for evidence-based research to support the effective integration of digital solutions in mental healthcare practices.

Mental healthcare during COVID-19

A systematic review of 61 papers by Kane, et al. (2022) revealed a heterogeneous integration of digital technologies in countries, contexts, and local regulations. It also depends on the modalities of care. However, high levels of using videoconferencing affect working conditions and therapeutic relationships. Many psychiatric and mental health professionals found an opportunity during the pandemic to develop their experience of remote care and better identify the potential and limitations of these digital technologies.

Healthcare workers are facing an increased risk of mental health issues due to the COVID-19 pandemic. These include burnout, fear, worry, distress, pressure, anxiety, and depression. These negative emotional stressors may affect healthcare workers leading to mental health problems. Digital technologies and platforms can mitigate psychological issues and provide effective support. Ye (2021) reviewed and analysed the mental health issues of healthcare workers during COVID-19 and proposed the MEET (Mental Health, Environment, Event, and Technology) framework. The framework revealed interactions among mental health, digital interventions, and social support. The mental health problems identified were anger, anxiety, obsessive-compulsive habits, traits and disorders, hypochondriasis, depression, sleep issues, physical discomfort and somatisation, cognitive issues of concentration and behavioural issues. The digital technology interventions were digital communication platforms, telehealth, internet-based interventions, web-based learning, artificial intelligence, mobile health, short videos, new media and social media.

A scoping review using 37 papers by Kemp, et al. (2020) showed that mental health can be improved by using digital technologies for compassionate care delivery. Its use leads to the identification of novel compassionate ways. However, continuous maintenance of such compassionate care delivery is essential to achieve the goals of care quality.

Another scoping review with 20 papers on digital technologies used for mental patients during COVID-19, Li (2023) dealt with the characteristics and effectiveness of digital interventions used for the improvement of mental health in the context of the COVID-19 pandemic. The review identified digital technologies as web-based and mobile-based platforms like social networking and video conferencing applications. However, the theoretical approaches from standardised psychological treatments could be noted only in less than half of the papers. Most studies reported positive effects of digital technologies for improving general mental and emotional well-being or addressing specific conditions like depression, stress, and anxiety.

The onset of COVID-19 has increased the use of telehealth for mental healthcare. According to Torous, et al. (2020) this is the opportune time to bend and accelerate the use of digital technologies for mental healthcare. Investments in this area can lead to current and future enhancement of quality in mental healthcare. The success of telehealth and various apps highlights the need for high-quality evidence, a trained workforce and digital equity.

In response to COVID-19, many governments committed large amounts to develop and popularise digital tools for mental healthcare. These included virtual care visits to hospitals and applications and

ISSN:1624-1940
DOI 10.6084/m9.figshare.2632599
http://magellanes.com/

other online methods. Some of the digital mental healthcare tools are online elements of psychotherapy like cognitive behavioural therapy (CBT), and chatbots. These are computer programs which use artificial intelligence (AI) and natural language processing. They determine the intent and engage in conversations with text or text-to-speech. The benefits of these tools are increased convenience for patients, enhanced compliance with appointments, and access to care that is beyond geography and evidence-based. These developments require matching changes in regulatory and compensatory frameworks. Increased investments are necessary in research on more secure and personalised digital technologies for mental healthcare (Gratzer, et al., 2021).

The COVID-19 pandemic resulted in a higher demand for mental health resources than were available, prompting an increased reliance on digital tools to address this gap. While digital technologies have the potential to enhance the efficiency and effectiveness of mental healthcare, the long-term viability of their implementation has been limited despite initial promising results in efficacy trials. The complexities inherent in mental health care call for a more diverse approach beyond traditional research methods. During the pandemic, web-based interventions gained popularity, offering affordable access to psychological therapies, although challenges like inadequate infrastructure and skills hindered the widespread adoption of digital solutions in mental health care. There is a need to align methodologies due to the rapid advancement of digital technologies outpacing the evaluation of robust digital mental health interventions and preventive strategies for mental illnesses. Integrating explainable artificial intelligence into digital mental health initiatives is seen as a means to achieve positive and responsible outcomes. Investments in digital platforms and corresponding apps for real-time assessment, monitoring, and treatment hold promise for cost-effective solutions in vulnerable populations. While the use of machine learning has faced limitations in study execution and reporting methodologies, the utilization of unstructured data has enhanced its potential benefits. Early indications suggest that the advantages of such technologies outweigh the drawbacks. Addressing the limitations of evidence-based approaches necessitates the integration of decision-support tools to aid policymakers in implementing digital mental health solutions. The multifaceted challenges surrounding effectiveness, equity, access, and ethics, including issues related to privacy, confidentiality, fairness, transparency, reproducibility, and accountability, require resolution. Establishing evidence-informed policies, creating high-quality digital products and services, and fostering skills in utilizing and maintaining these solutions are imperative. Research efforts should concentrate on developing digital platforms featuring apps based on explainable artificial intelligence to bolster resilience and assist mental health professionals in treatment decisions. Investments in digital mental health initiatives must prioritize safety and functionality. Encouraging end-users to promote innovative methods can help developers efficiently assess the value of their offerings and make them a worthwhile investment. Embracing technology-enabled services within a hybrid care model is likely to be effective, particularly for specialists using such services with vulnerable populations at risk, although severe cases of mental illness may require a different approach (Balcombe & De Leo, 2021). Table 2 highlights the summary of the findings of this review.

ISSN:1624-1940
DOI 10.6084/m9.figshare.2632599
http://magellanes.com/

Table 2. Summary of the findings of the review

Authors and Year	Study Design	Target Population	Findings
Lopes et al. (2021)	Innovative rehabilitation techniques	Schizophrenic patients	Focused on mental health rehabilitation and promotion of well-being from a holistic perspective
Hollis et al. (2015)	Editorial	General mental health patients	Highlighted the potential of digital technology to transform mental healthcare, with challenges in data privacy and workforce
Burr & Morley (2020)	Theoretical paper	General mental health patients	Proposed ethical principles for the use of digital technologies in mental healthcare
Gooding (2019)	Narrative review	General mental health patients	Discussed the ethical, legal, and social implications of digital technologies in mental healthcare
Sheehan & Hassiotis (2017)	Narrative review	Intellectually disabled individuals	Explored opportunities and risks of digital technologies in mental healthcare for intellectually disabled individuals
Goodman et al. (2021)	Examination of factors	Refugees	Emphasized the need for effective digital tools developed in partnership with refugee communities

ISSN:1624-1940
DOI 10.6084/m9.figshare.2632599
http://magellanes.com/

Rojas et al. (2019)	Mini-narrative review	General mental health patients	Discussed the feasibility, efficacy, and cost-effectiveness of internet-based interventions in less economically developed nations
Smith et al. (2023)	Consensus report	General mental health patients	Provided an overview of challenges and opportunities of digital technologies in mental healthcare
Kane et al. (2022)	Systematic review	General mental health patients	Revealed heterogeneous integration of digital technologies across countries and contexts
Ye (2021)	Review and analysis	Healthcare workers	Analyzed the mental health issues of healthcare workers during COVID-19 and proposed the MEET framework
Kemp et al. (2020)	Scoping review	General mental health patients	Showed the potential of digital technologies for compassionate care delivery
Li (2023)	Scoping review	General mental health patients	Identified digital interventions for mental health improvement during the COVID-19 pandemic
Torous et al. (2020)	Review	General mental	Highlighted the

ISSN:1624-1940
DOI 10.6084/m9.figshare.2632599
http://magellanes.com/

		health patients	need for investments in digital technologies for mental healthcare enhancement
Gratzer et al. (2021)	Review	General mental health patients	Discussed the benefits and challenges of digital mental healthcare tools
Balcombe & De Leo (2021)	Narrative review	General mental health patients	Emphasized the need for technology-enabled services within a hybrid care model for vulnerable populations

Discussion

Of the 15 papers reviewed, 7 dealt with mental healthcare during COVID-19. Thus, a lot of importance was given to accessibility to care by mental patients during the pandemic.

All 15 papers discussed various aspects related to digital technological methods of mental healthcare. None of them was a research paper. There were two narrative reviews in the case of general mental healthcare. There were four reviews (two scoping, one simple and one systematic) in the case of mental healthcare during COVID-19. Most papers were from the USA and European countries.

The papers discussed the available digital technologies for mental healthcare, the mental health conditions to which these technologies can be applied, socio-cultural contexts of equity and accessibility to care by all mental patients and legal and regulatory issues. Online and mobile applications were discussed in many papers.

The need for innovative rehabilitation methods for mental patients was discussed in one paper. Digital technologies to connect patients with services and health data, online and mobile applications, socio-cultural changes, government policies to promote digital technologies, privacy and big data challenges, and demand far-exceeding supply were some points discussed in many papers.

One interesting point was the missed opportunity cost if digital technologies are not adopted or delayed. This is because adopting digital technologies can reduce medical errors resulting in better patient outcomes and empowering mental patients.

Legal and regulatory frameworks to protect the rights of mental patients and accessibility, ethical, social and legal aspects were discussed in a few papers. One paper discussed the political and social concerns

ISSN:1624-1940
DOI 10.6084/m9.figshare.2632599
http://magellanes.com/

about power concentration with a few people and organisations and market forces denying or limiting access of mental patients to quality care. Collaborations at various levels have been proposed as the solution.

Marginalised, socially excluded and intellectually disabled mental patients need focused attention as they face many barriers to quality mental healthcare. They need support and adaptation of digital technologies suitable to their specific needs. Mental health problems are higher in the case of refugees mainly because of access barriers to healthcare in the host countries. This means, their accessibility needs to be increased by amending regulations if required.

A consensus report of a multi-country expert panel discussed various digital technology applications. Barriers to the widespread use of digital technologies in mental health include slow dissemination, limited workforce, privacy issues, health insurance concerns, the digital divide, slow research outputs, large data volumes, and the interdisciplinary nature of mental healthcare. Opportunities exist in developing new ways of utilizing digital technologies through multidisciplinary collaborations and promoting mobile healthcare. There are challenges related to ethics, regulation, data privacy, workforce training, and the need for evidence-based research to support the effective integration of digital solutions.

The seven papers on mental healthcare during COVID-19 mostly discussed the increased mental stress among people due to the pandemic and the associated movement restrictions making life difficult. During the pandemic, disruptions to routines were minimised by digital technologies. However, the use of too many videoconferences for mental health patients might have harmed them. Remote care experience of care specialists increased during the pandemic. The pandemic caused burnout, fear, worry, distress, pressure, anxiety, and depression among healthcare workers affecting their care capabilities. A MEET framework was proposed in the paper to support them. Another aspect discussed was digital technologies for compassionate care delivery to mental patients during the pandemic. One paper noted greater use of telehealth for mental healthcare due to limitations on face-to-face consultations during the pandemic.

Enumerating the biases identified in table 3 is discussed:

Publication Bias: The tendency for journals to publish positive results more frequently than negative or inconclusive findings in Google Scholar and PubMed, skewed the overall understanding of the effectiveness of digital technologies in mental health.

Selection Bias: Arising from the selection of studies based on specific inclusion criteria found on the PRISMA flowchart, excluded relevant research not meeting other important criteria.

Language Bias: Limiting the review to articles published in English, in Google Scholar and PubMed, excluded relevant studies published in other languages.

Time-Lag Bias: Research published more recently received more attention, potentially overlooking important older studies also published with the same outcomes and inclusions.

Citation Bias: Frequently cited studies from Google Scholar and PubMed received disproportionate weight, influencing the perceived importance of other findings from other search engines or non-online libraries.

Methodological Bias: Variations in study design, sample size, and data collection methods across

ISSN:1624-1940
DOI 10.6084/m9.figshare.2632599
http://magellanes.com/

studies introduced inconsistencies and affect the reliability of the conclusions.
Geographical Bias: Research conducted in specific regions may not be generalizable to other contexts, thus limited the applicability of the findings to other geographical locations.
Identifying and accounting for these biases was crucial for providing a balanced and accurate synthesis for digital technology used in the mental health domain.

Table 3. Biases found in this review

Author(s)	Publication Bias	Selection Bias	Language Bias	Time-Lag Bias	Citation Bias	Methodological Bias	Geographical Bias
Lopes et al. (2021)	Yes	Yes	Yes	No	No	Yes	Yes
Hollis et al. (2015)	Yes	Yes	Yes	Yes	No	Yes	Yes
Burr & Morley (2020)	Yes	Yes	Yes	No	No	Yes	Yes
Gooding (2019)	Yes	Yes	Yes	No	No	Yes	Yes
Sheehan & Hassiotis (2017)	Yes	Yes	Yes	No	No	Yes	Yes
Goodman et al. (2021)	Yes	Yes	Yes	No	No	Yes	Yes
Rojas et al. (2019)	Yes	Yes	Yes	No	No	Yes	Yes
Smith et al. (2023)	Yes	Yes	Yes	No	No	Yes	Yes
Kane et al. (2022)	Yes	Yes	Yes	No	No	Yes	Yes
Ye (2021)	Yes	Yes	Yes	Yes	No	Yes	Yes
Kemp et al. (2020)	Yes	Yes	Yes	Yes	No	Yes	Yes
Li (2023)	Yes	Yes	Yes	Yes	No	Yes	Yes
Torous et al. (2020)	Yes	Yes	Yes	Yes	No	Yes	Yes
Gratzer et	Yes	Yes	Yes	Yes	Yes	Yes	Yes

ISSN:1624-1940
DOI 10.6084/m9.figshare.2632599
http://magellanes.com/

al. (2021)							
Balcombe & De Leo (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Conclusions

This study showed many benefits, problems and challenges of using digital technologies for the mental health domain. Online and mobile applications have been very useful in this regard, especially during the COVID-19 period. Greater focus with adequate support is necessary for intellectually disabled, socio-economically backward and refugee mental patients, as they face many barriers in accessing quality mental healthcare. Ethical, legal and regulatory aspects are important in all these respects. Future research may focus more on applications of artificial intelligence and machine learning methods as digital technologies for mental healthcare.

References

Aguilera, A., 2015. Digital technology and mental health interventions: Opportunities and challenges. *Arbor,* 191(771), p. e210.

Balcombe, L. & De Leo, D., 2021. Digital mental health challenges and the horizon ahead for solutions. *JMIR Mental Health,* 8(3), p. e26811.

Begi, N., Magoma, C. & Mwololo, J. N., 2023. Integration of Information, Media and Digital Technologies Into Curriculum Implementation in Kenyan Universities. In: J. Keengwe & J. Gikandi, eds. *Competence-Based Curriculum and E-Learning in Higher Education.* s.l.:IGI-Global, pp. 162-179.

Burr, C. & Morley, J., 2020. Empowerment or engagement? Digital health technologies for mental healthcare. In: C. Burr & S. Milano, eds. *The 2019 Yearbook of the Digital Ethics Lab. Digital Ethics Lab Yearbook.* s.l.:Springer, Cham, pp. 67-88.

Cohn, J. G., 2024. What happened in 2019. In: *A Critical Examination of the Recent Evolution of B2B Sales.* s.l.:IGI-Global, pp. 51-63.

Gooding, P., 2019. Mapping the rise of digital mental health technologies: Emerging issues for law and society. *International journal of law and psychiatry,* Volume 67, p. 101498.

Goodman, R., Tip, L. & Cavanagh, K., 2021. There's an app for that: Context, assumptions, possibilities and potential pitfalls in the use of digital technologies to address refugee mental health. *Journal of Refugee Studies,* 34(2), pp. 2252-2274.

ISSN:1624-1940
DOI 10.6084/m9.figshare.2632599
http://magellanes.com/

Gratzer, D. et al., 2021. Our digital moment: innovations and opportunities in digital mental health care. *The Canadian Journal of Psychiatry,* 66(1), pp. 5-8.

Hollis, C. et al., 2015. Technological innovations in mental healthcare: harnessing the digital revolution. *The British Journal of Psychiatry,* 206(4), pp. 263-265.

Kane, H. et al., 2022. Opportunities and challenges for professionals in psychiatry and mental health care using digital technologies during the COVID-19 pandemic: systematic review. *JMIR Human Factors,* 9(1), p. e30359.

Kemp, J. et al., 2020. Delivery of compassionate mental health care in a digital technology–driven age: scoping review.. *Journal of Medical Internet Research,* 22(3), p. e16263.

Li, J., 2023. Digital technologies for mental health improvements in the COVID-19 pandemic: a scoping review. *BMC Public Health,* 23(1), p. 413.

Lopes, R. P. et al., 2021. Digital technologies for innovative mental health rehabilitation. *Electronics,* 10(18), p. 2260.

Pullen, D. L., 2009. Back to Basics: Electronic Collaboration in the Education Sector. In: J. Salmons & L. Wilson, eds. *Handbook of Research on Electronic Collaboration and Organizational Synergy.* s.l.:IGI Global, pp. 205-222.

Rojas, G. et al., 2019. Improving mental health care in developing countries through digital technologies: a mini narrative review of the chilean case. *Frontiers in public health,* Volume 7, p. 463908.

Sheehan, R. & Hassiotis, A., 2017. Digital mental health and intellectual disabilities: state of the evidence and future directions. *BMJ Mental Health,* 20(4), pp. 107-111.

Smith, K. A. et al., 2023. Digital mental health: challenges and next steps. *BMJ Ment Health,* 26(1), pp. 1-7.

Srivastava, K. et al., 2020. Digital technological interventions in mental health care. *Industrial Psychiatry Journal,* 29(2), pp. 181-184.

Torous, J., Myrick, K. J., Rauseo-Ricupero, N. & Firth, J., 2020. Digital mental health and COVID-19: using technology today to accelerate the curve on access and quality tomorrow. *JMIR mental health,* 7(3), p. e18848.

ISSN:1624-1940
DOI 10.6084/m9.figshare.2632599
http://magellanes.com/

Ye, J., 2021. Advancing mental health and psychological support for health care workers using digital technologies and platforms. *JMIR Formative Research,* 5(6), p. e22075.