Bridging Mental Health Gaps in Underserved Communities: A Systematic Review of Digital Technologies and Agronursing as Complementary Interventions

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ABSTRACT

Background: The integration of digital mental health technologies presents transformative opportunities for addressing service gaps in underserved and resource-limited areas. **Purpose:** The objective was to identify, evaluate, and summarize peer-reviewed studies that explored both opportunities and challenges associated with digital mental health interventions in rural, remote, and resource-limited settings. **Methods:** This systematic review synthesizes evidence from 10 peer-reviewed studies to evaluate the effectiveness, accessibility, and challenges of implementing telemedicine, mobile health (mHealth), SMS-based interventions, and digital platforms across diverse global contexts. **Result:** Findings reveal that digital tools significantly improve access to care by overcoming geographic barriers, reducing stigma, and enabling remote treatment delivery. However, challenges such as inadequate digital infrastructure, data privacy concerns, and limited digital literacy hinder equitable adoption. The study further explores agronursing defined as therapeutic agricultural practices as a complementary, community-centered approach to supporting mental well-being, particularly in rural settings. **Conclusions:** By combining technological innovation with nature-based therapies, this review highlights pathways toward more inclusive and sustainable mental health service delivery. These insights are critical for policymakers and healthcare providers aiming to address global mental health disparities through context-sensitive solutions.

KEYWORDS

Agronursing, Digital mental health, mHealth, Rural mental health, Telemedicine

1. BACKGROUND

Mental health disorders represent a growing global public health challenge, with an estimated one in seven individuals affected worldwide. Despite increasing awareness and investment in mental health services, significant disparities persist in access to care, particularly for populations

residing in rural, remote, and resource-limited settings(Maha et al., 2024; Park et al., 2022). In these underserved areas, barriers such as geographic isolation, shortages of trained professionals, limited healthcare infrastructure, and stigma often prevent individuals from seeking or receiving timely and effective treatment. As traditional models of service delivery struggle to meet the rising demand, innovative solutions are urgently needed to bridge the widening gap between mental health needs and available resources.

Digital mental health technologies encompassing telemedicine, mobile health (mHealth), SMS-based interventions, and web-based platforms have emerged as promising tools to expand access to mental health care. These technologies offer opportunities to overcome conventional limitations by enabling remote consultations, self-guided therapy, real-time monitoring, and psychoeducation (de Rosa & Chang, 2024; Steyn & Slabbert, 2023). Their potential is especially relevant in low- and middle-income countries (LMICs), where systemic challenges have long hindered the availability and affordability of mental health services. Growing evidence suggests that digital interventions can be effectively adapted to diverse cultural contexts, providing scalable and cost-efficient alternatives to traditional face-to-face care. Moreover, the integration of non-digital complementary approaches, such as agronursing defined as the application of agricultural practices within therapeutic and nursing frameworks has shown emerging promise in supporting emotional well-being and recovery among vulnerable populations (Kruzan et al., 2022; Schleider et al., 2019).

The integration of digital tools into mental health service delivery has also demonstrated benefits beyond accessibility. Digital platforms can help reduce perceived stigma by offering discreet and anonymous avenues for care, encouraging help-seeking behavior among individuals who might otherwise avoid treatment (Obuobi-Donkor et al., 2023, 2025). Furthermore, they facilitate continuity of care through features such as appointment reminders, symptom tracking, and digital therapeutic support, which enhance patient engagement and treatment adherence. Agronursing complements these efforts by introducing structured, nature-based therapeutic activities such as horticultural therapy and farm-assisted care that provide additional psychosocial support, particularly in rural and low-resource environments where digital infrastructure may be limited.

Together, digital and nature-based interventions offer a dual pathway to address mental health disparities through both technological innovation and holistic, community-centered care (Alam et al., 2024; Owusu et al., 2025; Schleider et al., 2021).

This systematic review contributes novel insights by synthesizing current evidence on the implementation of digital mental health technologies specifically in underserved contexts, while also exploring how agronursing can serve as a complementary strategy to improve mental health outcomes. By consolidating findings from high-, middle-, and low-income country settings, This review seeks to provide valuable insights that can help shape public policies, direct further scientific studies, and promote fair access to new solutions that combine technology and natural environments in mental healthcare around the world.

2. METHODS

This study employed a systematic literature review to synthesize evidence on the implementation of digital mental health technologies in underserved areas. The method followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency, replicability, and scientific rigor. The objective was to identify, evaluate, and summarize peer-reviewed studies that explored both opportunities and challenges associated with digital mental health interventions in rural, remote, and resource-limited settings.

A comprehensive search was conducted across multiple electronic databases including Scopus, PubMed, Web of Science, IEEE Xplore, ScienceDirect, ProQuest, SpringerLink. The search terms were constructed using Boolean operators and included combinations of keywords related to: Digital health / eHealth / mHealth / telemedicine; Mental health / psychological intervention / behavioral health; Underserved populations / low-resource; settings / rural areas / remote communities

Table 1. PRISMA Flow Diagram of Study Selection Process

STEP	DESCRIPTION	NUMBER OF RECORDS
1	**Identification**	1678
	Electronic database search results (Scopus, PubMed, Web of Science, IEEE Xplore, ScienceDirect, ProQuest, SpringerLink)	527
	Additional records identified through other sources (e.g., reference lists, expert recommendations)	15
	Total records after duplicates removed	482
2	**Screening**	
	Records excluded based on title and relevance	360
	Records screened by abstract	122
	Records excluded after abstract screening	78
	Full-text articles assessed for eligibility	44
3	**Eligibility**	
	Articles excluded with reasons (e.g., not relevant population, non-peer-reviewed, outside timeframe, no full text)	34
4	**Included**	
	Articles included in the qualitative synthesis	10

Search string used: ("digital mental health" OR "ehealth" OR "telemedicine") AND ("underserved areas" OR "low-income countries" OR "remote regions") AND ("implementation" OR "accessibility" OR "challenges").

The search was limited to peer-reviewed journal articles published in English, from January 2014 to December 2024, to ensure up-to-date findings while aligning with recent technological advancements.

Table 2. Inclusion and Exclusion Criteria

Category	Inclusion Criteria	Exclusion Criteria
Population	Studies focusing on underserved populations, including rural, remote, or low-resource communities	Urban-focused or general population studies
Intervention	Digital mental health tools (e.g., mobile apps, SMS-based therapy, teleconsultation, online platforms)	Non-digital interventions
Outcome	Studies reporting on accessibility, effectiveness, barriers, or facilitators of digital mental health services	Studies without clear outcomes or qualitative descriptions
Study Design	Peer-reviewed original studies (quantitative, qualitative, mixed-methods)	Editorials, commentaries, conference abstracts, and non-scientific reports
Timeframe	Published between 2014 and 2024	Older than 2014

The selection process consisted of three stages: 1) Title Screening: Irrelevant studies were excluded based on title relevance; 2) Abstract Screening: Full abstracts were reviewed to determine eligibility; 3) Full-text Review: All potentially relevant articles were read in full and assessed against inclusion criteria. Two independent reviewers performed the screening and data extraction process. Disagreements were resolved through discussion or consultation with a third reviewer.

A standardized data extraction form was developed to systematically collect key information from the included studies. This form captured study characteristics such as author(s), publication year, country of origin, and journal name. It also documented the study design and methodology employed, along with details regarding the target population and sample size. The type of digital technology utilized in each study was recorded, as well as the specific implementation setting in which it was applied. Additionally, the form gathered reported outcomes, including both opportunities and challenges encountered. Finally, the methodological quality of each included study was assessed and recorded to ensure a critical appraisal of the evidence.

The methodological quality of the included studies was rigorously assessed using appropriate critical appraisal tools tailored to each study design: the CASP (Critical Appraisal Skills Programme) checklist was used for quantitative studies, the JBI (Joanna Briggs Institute) checklist for qualitative studies, and AMSTAR-2 (A MeaSurement Tool to Assess systematic Reviews) for systematic reviews. Only studies rated as having moderate to high methodological quality were included in the final synthesis to ensure the reliability and validity of the findings. For data synthesis, a thematic synthesis approach was employed to integrate findings across the selected studies. This process involved systematically coding the extracted data into key thematic categories, including accessibility, privacy, infrastructure, and cultural appropriateness, allowing for a comprehensive and coherent synthesis of the evidence.

3. Results

Table 3. Implementation of Digital Mental Health Technologies in Underserved Areas

No	Study/reference	Region	Key findings	Opportunities	Challenges
1	Smith-MacDonald et al., 2021	Global	Enhances access to mental health services by removing transportation barriers and stigma	Improves accessibility for rural populations and individuals with social anxiety	Requires adequate digital infrastructure
2	Ricciardelli et al., 2020	Global	Technology helps overcome lack of mental health services in remote areas	Expands service coverage to hard-to-reach locations	Low digital literacy and awareness
3	Luxton et al., 2015	United States	Users feel more comfortable using digital services due to privacy	Reduces stigma associated with seeking help	Data security and confidentiality concerns
4	Ashwick et al., 2019	Australia	Digital services increase participation in mental health care	Offers flexibility in treatment decision-making	Internet connectivity issues
5	Acierno et al., 2016	United States	Online therapy is effective for anxiety and trauma disorders	Reaches geographically isolated populations	Limited technical support and training
6	Khalid et al., 2023 (RCT)	Pakistan	SMS interventions reduce symptoms of depression and anxiety in primary care patients	Simple yet effective solution for low-income countries	Unstable communication infrastructure
7	Arjadi et al., 2015	LMICs	Mobile health improves outcomes for depression, anxiety, and PTSD	Scalable solutions across diverse cultural contexts	Reliance on mobile phone ownership
8	Ardi et al., 2024	Southeast Asia	Digital platforms enhance cross-sector coordination	Enables integrated services across regions	Need for regulatory and data governance frameworks
9	Marquez et al., 2016	Sub-Saharan Africa	ICT supports screening, diagnosis, and training for non-specialist workers	Strengthens local healthcare capacity	Lack of electricity and hardware limitations
10	Farrington et al., 2014	Europe	Mobile apps aid in patient monitoring and counseling	Allows personalized interventions tailored to local context	System interoperability issues

4. DISCUSSION

The findings of this systematic review highlight the transformative potential of digital mental health technologies in addressing service gaps in underserved and remote areas. Digital tools such as mobile applications, telemedicine, and SMS-based interventions have demonstrated significant promise in improving access to care by overcoming traditional barriers including geographic isolation, transportation challenges, and limited availability of mental health professionals (Torous et al., 2023). These results align with global evidence showing that technology-enabled services can serve as a critical bridge for populations with historically restricted access to mental health support (Herzog et al., 2021).

One of the key opportunities identified is the ability of digital platforms to reduce stigma and increase user comfort in seeking help, particularly among individuals with social anxiety or concerns about privacy (Sander et al., 2016). This supports previous studies indicating that asynchronous and remote modalities provide a sense of safety and anonymity, which may encourage more people to engage with mental health services. Additionally, mobile health (mHealth) interventions have shown effectiveness across diverse cultural and economic settings, particularly in low- and middle-income countries (LMICs), where they offer scalable solutions for addressing high burdens of untreated mental disorders (Rojas et al., 2019).

Despite these benefits, the implementation of digital mental health technologies faces several systemic and contextual challenges. Inadequate digital infrastructure, including unreliable internet connectivity and lack of electricity, remains a major barrier, especially in rural and resource-limited settings (Raphiphatthana et al., 2019). Moreover, issues related to data privacy, security, and ethical considerations in handling sensitive mental health information require robust governance frameworks to ensure safe and responsible use of digital tools (Alqablan & Almahboub, 2022). The reliance on mobile phone ownership and digital literacy further complicates equitable access, highlighting the need for context-specific and inclusive design approaches.

The findings also emphasize the importance of cross-sector collaboration in scaling digital mental health initiatives. Successful implementation requires coordinated efforts between healthcare providers, technology developers, policymakers, and local communities to

create integrated systems that are both effective and sustainable (Chutiyami et al., 2025). Such integration not only enhances service delivery but also facilitates data-driven decision-making and policy development, which are essential for long-term impact in LMICs and other underserved regions.

Moreover, the absence of dialogue between agronursing and digital technologies in mental health literature reflects not only methodological or disciplinary divides but also an epistemological bias that privileges high-tech solutions as "innovative," while framing nature and community-based approaches as "traditional" or merely "complementary" even when they prove more sustainable and culturally resonant in specific contexts. In fact, in remote and low-resource settings where digital connectivity is unstable, agronursing can serve as a resilient therapeutic foundation, while digital tools may function as valuable supplements for instance, through companion apps for scheduling therapeutic farming activities, WhatsApp groups for peer support among farmer-patients, or teleconsultation platforms staffed by therapists trained in agronursing principles. Integrating these modalities is not merely about expanding intervention options; it is also an act of decolonizing our understanding of "innovation" in mental health recognizing that the most effective solutions often emerge from the synthesis of technology and local wisdom, of data and soil, of screens and gardens.

While this review provides valuable insights into the current landscape of digital mental health implementation, it is not without limitations. The heterogeneity of study designs and contexts limits direct comparability across findings. Furthermore, the exclusion of grey literature may result in publication bias. Future research should focus on longitudinal evaluations of digital interventions, including cost-effectiveness analyses and participatory co-design processes involving end-users. By addressing these gaps, stakeholders can better harness the potential of digital technologies to promote mental health equity globally.

The Role of Agronursing in Promoting Mental Health and Emotional Well-being

Agronursing defined as the integration of agricultural practices within therapeutic and nursing frameworks has demonstrated emerging potential in promoting mental health and emotional well-being, particularly

among vulnerable populations. This review reveals that structured engagement in agricultural activities such as horticultural therapy, farm-based interventions, and nature-assisted care can significantly reduce symptoms of anxiety, depression, and stress, especially for individuals with chronic mental illnesses or those recovering from psychosocial trauma (Muñoz-Ortega et al., 2024). These findings align with broader evidence supporting ecotherapy and green care models, which emphasize the restorative effects of natural environments on cognitive function and emotional regulation. Agronursing builds on these benefits by incorporating elements of caregiving, routine, and social interaction into therapeutic agricultural settings, offering a holistic and accessible approach to mental health rehabilitation. Its applicability in rural and underserved communities further highlights its value in addressing gaps in traditional mental health services, particularly where access to professional psychological support is limited (Kozelka et al., 2021). However, while current evidence is promising, most studies remain exploratory, with limited methodological standardization and long-term outcome evaluations. Therefore, further empirical research is needed to develop robust agronursing protocols and assess their effectiveness across diverse cultural, clinical, and socioeconomic contexts (Batra & Erbas, 2025; Klein et al., 2024).

This study has several limitations that should be considered when interpreting the findings. First, the heterogeneity in study designs, populations, and outcome measures across the included studies limited the ability to conduct a meta-analysis or make direct quantitative comparisons. Second, the review focused exclusively on peer-reviewed journal articles published in English between 2014 and 2024, which may have introduced publication and language bias, potentially excluding relevant grey literature or non-English research. Third, the contextual variability in defining "underserved areas" across different regions may affect the generalizability of the findings. Lastly, most of the included studies reported short-term outcomes, leaving gaps in understanding the long-term effectiveness and sustainability of digital mental health interventions in resource-limited settings.

5. CONCLUSION

The implementation of digital mental health technologies demonstrates

significant potential to address longstanding gaps in mental health service delivery within underserved and resource-limited settings. This systematic review highlights that interventions such as telemedicine, mobile health applications, and SMS-based therapies can effectively improve access to care, reduce stigma, and support treatment adherence, particularly for rural populations and individuals with limited mobility. However, the successful adoption of these technologies is contingent upon overcoming critical challenges including inadequate digital infrastructure, concerns around data privacy, and disparities in digital literacy. Context-specific design, cross-sector collaboration, and robust governance frameworks are essential to ensure equitable and sustainable implementation. While current evidence supports the transformative role of digital tools in expanding mental health access, further longitudinal and contextually grounded research is needed to evaluate long-term effectiveness and scalability across diverse sociocultural and economic environments. Policymakers, healthcare providers, and technology developers must work collaboratively to harness these innovations responsibly and equitably, particularly in low- and middle-income countries where mental health needs remain disproportionately unmet.

AUTHOR CONTRIBUTIONS

Evy Aristawati, Bagus Dwi Cahyono, Nurul Huda, Ronal Surya Aditya, Ana Apriana contributed to the conception and design of the study, data collection, and manuscript writing. Evy Aristawati was responsible for manuscript revisions and final approval of the version to be published. All authors have read and approved the final manuscript.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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DATA AVAILABILITY

Supplemental data will be provided upon request.

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