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Factors That Influence Digital Health Implementation in Rural, Regional, and Remote Australia: An Overview of Reviews and Recommended Strategies

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ABSTRACT

Introduction: Digital transformation can enhance health and healthcare delivery; however, its application in rural, regional, and remote (RRR) areas presents considerable, underexplored challenges. While the benefits of digital health for underserved areas are evident, we must understand and address the challenges to fully realise its impact.

Objective: To synthesise the evidence for factors influencing the implementation of digital health in RRR Australia and recommend implementation strategies to address barriers.

Design: An overview of existing reviews was conducted to identify relevant systematic and scoping reviews. Review quality was assessed using the AMSTAR-2 tool. Barriers and enablers to implementation were mapped using the Consolidated Framework for Implementation Research (CFIR), and strategies to address barriers were identified based on the Expert Recommendations for Implementation Change (ERIC).

Findings: Three reviews met the inclusion criteria; each was focused on telehealth and remote monitoring technologies. Influencing factors were identified across five CFIR domains, encompassing 16 barrier and 12 enabler constructs. While gaps in evidence on health outcomes were noted, the benefits of implementation, such as improved access to services, reduced travel, and enhanced patient satisfaction, were highlighted. The recommended implementation strategies involved tailoring interventions to local needs, fostering local leadership and advocacy, planning and structuring implementation, and mobilising resources.

Conclusion: This study identified key influencing factors and recommended implementation strategies to mitigate barriers. These strategies, if employed, could facilitate the successful implementation of digital health in RRR Australia.

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1 | Background

Rural, regional, and remote (RRR) areas of Australia are characterised by small, widely dispersed populations spread across more than 95% of the country's landmass [1]. This presents significant challenges to equitable healthcare delivery for almost one-third of the population. It is well documented that people living outside Australia's major urban centres experience higher mortality rates, dying at younger ages than their urban counterparts, and are more likely to be diagnosed with chronic conditions such as asthma, cardiovascular disease, chronic kidney disease, and diabetes [1]. The total burden of disease is

Summary

- What is already known about this subject?
  - RRR areas of Australia face considerable challenges in healthcare delivery, namely due to geographical isolation, small populations, and limited access to healthcare services. These factors contribute to higher disease burdens and lower life expectancies compared to urban areas.
  - The successful implementation of digital health initiatives is crucial, as digital infrastructure is becoming the foundation of modern healthcare, particularly in RRR areas facing workforce shortages. It plays a vital role in improving access to high-quality care in these regions.
  - Understanding the factors that influence the successful implementation of digital health is essential for ensuring that RRR populations can benefit from improved healthcare delivery.
- What this study adds?
  - Multiple factors influence the implementation of digital health in RRR Australia, demonstrating that no single barrier or enabler predominates. This insight is crucial for developing targeted strategies that consider the complexities of the healthcare environment, as highlighted by the CFIR framework.
  - The findings emphasise the significance of the 'inner setting' context in successful implementation. This reinforces the need for tailored approaches that consider local characteristics, including leadership, culture, and existing workflows to enhance the relevance and effectiveness of digital health.
  - Actionable implementation strategies include stakeholder engagement, contextual understanding, formal planning, and resource mobilisation. These serve as a roadmap to overcome the barriers to the successful integration of digital health in RRR settings.

1.4 times higher in remote areas, and the challenge is further compounded by limited access to healthcare services in remote and very remote regions. Data from Medicare indicates that the number of non-hospital-referred attendances, such as visits to general practitioners, is significantly lower in these areas, and this disparity is exacerbated by a chronic shortage of healthcare professionals and providers. In 2022, there were 205 FTE clinical Medical Practitioners per 100 000 people in very remote areas compared with 427 FTE per 100 000 people in major cities, and nearly every health profession has experienced a decline in availability per 100 000 people with increasing rurality [2]. Addressing the geographic, financial, social, cultural, and mobility barriers to ensure inclusive access to healthcare remains a significant challenge for Australia and many other nations. To address both the elevated disease burden and the geographic challenges faced by rural and remote populations, digital health is promising.

Digital health is at the intersection of healthcare and digital technologies, focusing on the optimal use of technology to improve the health and well-being of individuals and populations and strengthen health systems [3]. It encompasses the application of patient-facing technologies, including telehealth systems, web-based platforms, and smartphone applications, and methodologies in healthcare delivery used to aid in the prevention, diagnosis, treatment, and self-management of health [4]. Evidence supports the efficacy of digital health technologies in addressing and preventing various health conditions in various settings [5–7], and overcoming barriers that patients commonly experience within the healthcare system [8, 9].

In recent years, digital communication tools and advanced medical technologies have become increasingly integral to best-practice healthcare. The National Digital Health Strategy 2023–2028 [10] and the National Healthcare Interoperability Plan 2023–2028 [11] outlines the opportunities for digital health to support national reform and address emerging contemporary health system challenges. Furthermore, the 2024 Productivity Commission research report "Levering digital technology in healthcare" [12] highlights the potential and mechanisms for significant cost savings to the health system (more than $5 billion annually) where digital technologies are more effectively integrated into healthcare. While the development of digital health in Australia has progressed at an impressive rate, there remain significant areas across the country where access to, and the quality of, digital services are limited. Low-quality connectivity outside of Australia's urban centres continues to be a persistent challenge [12]. Although large-scale national infrastructure programs have generally focused on enhancing rural connectivity, nearly half of Australia's regions still experience gaps in digital infrastructure [13]. This underscores a pronounced and enduring rural–urban digital divide. Despite recent investments in telecommunications infrastructure and services, substantial inequalities in access to digital resources persist in rural areas [14, 15]. Digital health and connectivity are recognised as crucial enablers of the health system in RRR Australia; however, many individuals are unable to fully benefit from these advancements. Among those most affected are First Nations Australians of the 1545 remote communities and homelands, who remain some of the most digitally excluded populations in Australia [13, 16].

There is an extensive body of evidence surrounding digital health studies; however, this is predominantly centred on urban settings, which benefit from higher population density, better access to resources, established infrastructure, proximity to diverse healthcare providers, fewer logistical challenges, and greater funding opportunities. This focus makes it challenging for healthcare professionals, researchers, and policymakers to identify and apply strategies most relevant to RRR Australia. This underscores the importance of having accessible, synthesised evidence and clear, well-characterised guidelines for the implementation of digital health in RRR Australia.

Implementation science offers established methods for categorising barriers and enablers to the implementation of innovations, as well as identifying strategies for addressing the barriers and leveraging enablers. The Consolidated Framework for Implementation Research (CFIR) is well suited for assessing community and health system-level factors that affect implementation [17]. The CFIR is structured into five domains

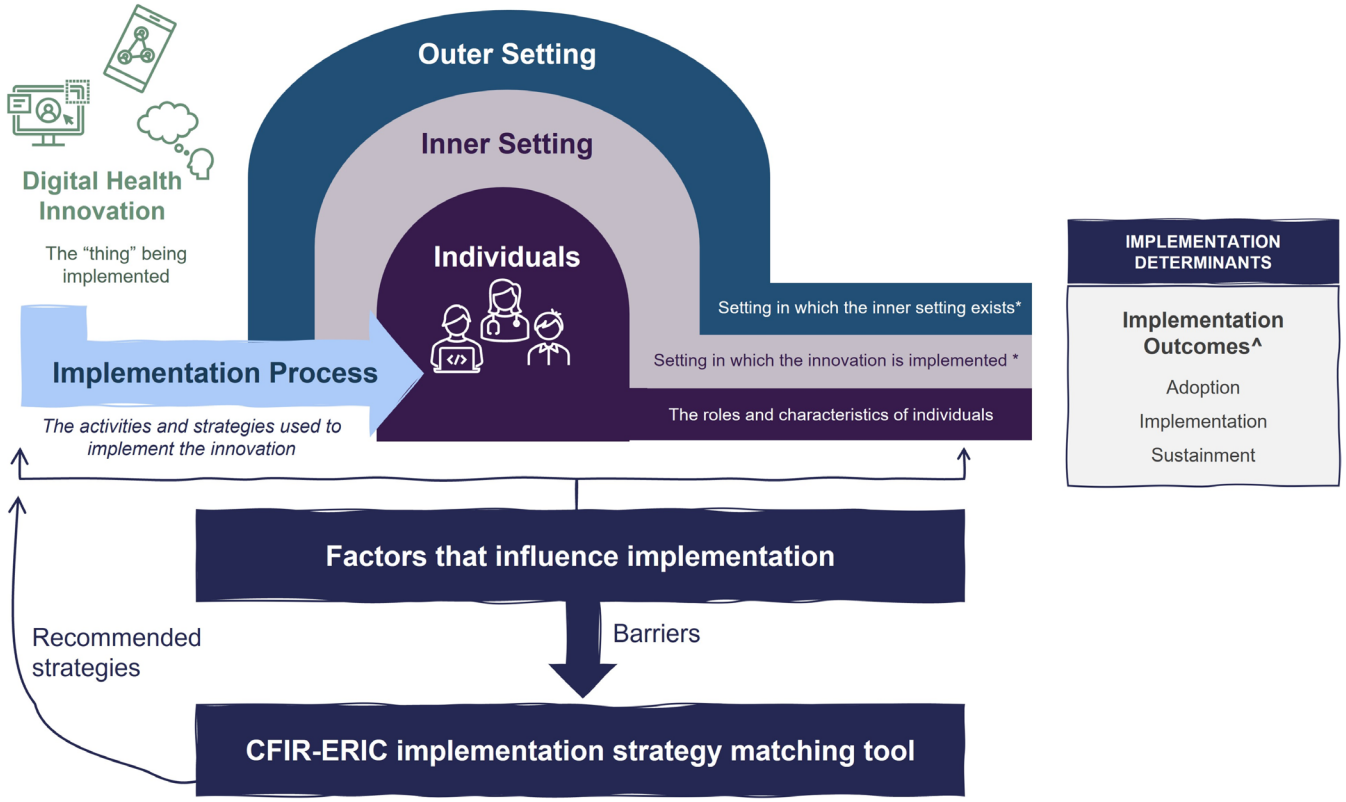

FIGURE 1 | Framework used in this study to analyse factors that influence digital health implementation in RRR Australia; adapted from [20].

(innovation characteristics, individual characteristics, inner setting, outer setting, and implementation process), which are further sub-divided into 39 constructs that can positively or negatively influence implementation [17]. In the context of digital health implementation in RRR Australia, the *innovation* refers to the innovation being implemented, such as wearable devices, telehealth platforms, electronic health records, or artificial intelligence applications. *Individual characteristics* are the roles and attributes of those involved in the implementation process, including leaders, facilitators, team members, support staff, service providers, and recipients of care. The *inner setting* represents the specific environment in which the innovation is being deployed. This may refer to a particular location, organisation, or system, such as a hospital, school, outreach clinic, or a combination of multiple settings relevant to rural and remote healthcare. The *outer setting* encompasses factors beyond the immediate organisation or system, including the wider healthcare infrastructure, such as overarching hospital networks, regional healthcare authorities, or national health departments. Lastly, the *implementation process* refers to the activities and strategies used to facilitate the adoption of the innovation. This process may involve engaging key stakeholders, providing education and training, and fostering local consensus-building to ensure the successful integration of digital health interventions in rural and remote healthcare contexts.

In this study, the CFIR served as the organising framework for categorising influencing factors into barriers and enablers [18, 19], and then expert-recommended implementation strategies (ERIC) were identified using the CFIR-ERIC matching tool (Figure 1). This tool is informed by expert consensus (developed by a panel of implementation science and clinical practice experts) to prioritise strategies most strongly aligned with overcoming specific CFIR barriers. From a set of 73 possible implementation strategies, it generates a tailored set of ERIC strategies that match each barrier, providing level 1 endorsed strategies (i.e., $>50\%$ of the experts ranked this as one of their top seven strategies for that barrier) and level 2 endorsed strategies (i.e., between 20% and 50% of the experts ranked this as one of their top seven strategies for that barrier) [18, 19]. It is the intention that these recommended strategies be considered when planning for future digital health implementation efforts. In addition, 'actual' implementation outcomes, which are based on perceptions or measures of current (or past) implementation success or failures, were assessed. As conceptualised by the CFIR Outcomes Addendum [20], 'actual' outcomes include the determinants: adoption (whether the decision is made to deliver the innovation), implementation (whether delivery of the innovation occurs), and sustainment (whether the delivery of the innovation continues in the long term).

The primary objective of this overview of reviews is to consolidate the evidence related to factors influencing the implementation of digital health in RRR Australia. To achieve this, we summarise the characteristics of published systematic and scoping reviews related to the implementation of digital health in RRR Australia, identify and categorise factors that influence the implementation of digital health (specifically the barriers and enablers according to the CFIR), and generate recommended implementation strategies using the CFIR-ERIC tool. Our approach aims to provide a comprehensive synthesis of the literature, acknowledging the multi-level complexity of implementation, and offering practical recommendations for planning future digital health initiatives in RRR Australia.

TABLE 1 | Eligibility criteria.

Criteria	Inclusion	Exclusion
Population	People who the digital health innovation is designed to benefit (i.e., patients, healthcare providers, end-users) or people who are directly or indirectly involved with delivering the innovation, including the key-decision makers within the implementing setting	
Intervention	Digital health innovations that focus on changing one or more health outcomes, quality of care, health, and healthcare needs, or designed to support clinical decision-making; technology is the primary focus of the innovation or mode of delivery	Use of a digital health innovation solely for administrative purposes, clinical education, training/coaching, supervision, or app design/development; focus on general perceptions, satisfaction or acceptance or is secondary to a more complex programme or intervention
Comparison	Not limited to comparator studies	
Outcome	Describes barriers and enablers, and/or reports broader findings and reflections about the implementation	
Study Setting	Rural, regional, or remote Australia; all healthcare settings considered; not limited by clinical area, health concern, or quality of care outcome	International studies that do not include Australian studies, or international studies where Australian content is not sufficiently described

2 | Methods

This overview of reviews adheres to the Cochrane guidelines for conducting overviews of reviews [21] and is reported according to the Preferred Reporting Items for Overviews of Reviews (PRIOR) [22]. The detailed methodology for this review has been published elsewhere (https://www.medrxiv.org/content/10.1101/2024.11.13.24317285v1) and is registered with the Prospective Register of Systematic Reviews (registration number: CRD42024512742).

2.1 | Eligibility Criteria

Eligible studies included qualitative, quantitative, and mixed-methods systematic or scoping reviews (with or without meta-analysis) focused on the implementation of digital health in RRR Australia. Reviews were not limited to comparator studies and included regardless of whether they assessed digital health interventions in comparison to usual care, face-to-face services, or alternative digital approaches. Digital health was considered a product, tool, innovation, digital medicine or digital therapeutic designed to change one or more health behaviours and contingent on the degree to which it improves one or more health outcomes (i.e., clinical, quality of care, healthcare services) [23]. Implementation was considered the process by which an innovation was introduced and applied [24]. Studies that exclusively addressed perspectives on adoption prior to the implementation of an innovation were beyond the scope of this review. Such studies were deemed to relate to the preliminary decision-making phase of using an innovation, which conceptually differs from the implementation process itself. Table 1 presents the eligibility criteria according to population, intervention, comparison, outcomes, and study setting.

2.2 | Search Strategy

The databases Medline, SCOPUS, Web of Science, CINAHL, and the Cochrane Library were searched from inception to 01 May 2024 (see Supporting Information 1). Database-specific indexing terms and free-text words were combined using the Boolean operators "AND" and "OR" for four key concepts (1) digital health, (2) RRR [25], (3) implementation, and (4) barriers and enablers. The search was limited to the English language, and the reference lists of eligible reviews were consulted.

2.3 | Study Selection

Search results were imported into the EndNote reference management software (Endnote version 20). Duplicates were removed automatically and checked manually. Titles and abstracts of all identified records were assessed, and full-text papers of references deemed potentially eligible or lacking sufficient information for exclusion were obtained and further assessed for eligibility against the predefined selection criteria. Two researchers (R1 and R2) independently conducted these two stages. Any discrepancies between reviewers were resolved through discussion, and a percentage of agreement > 80% was considered adequate [26]. The reasons for exclusion at stage two were recorded and detailed in the flow diagram (Figure 2).

2.4 | Study Quality

Using the Assessment of Multiple Systematic Reviews (AMSTAR-2) tool, two researchers (R2 and R3) independently evaluated the quality of included reviews [27]. The AMSTAR-2 tool is based on 7 significant domains and 16 questions, assigning

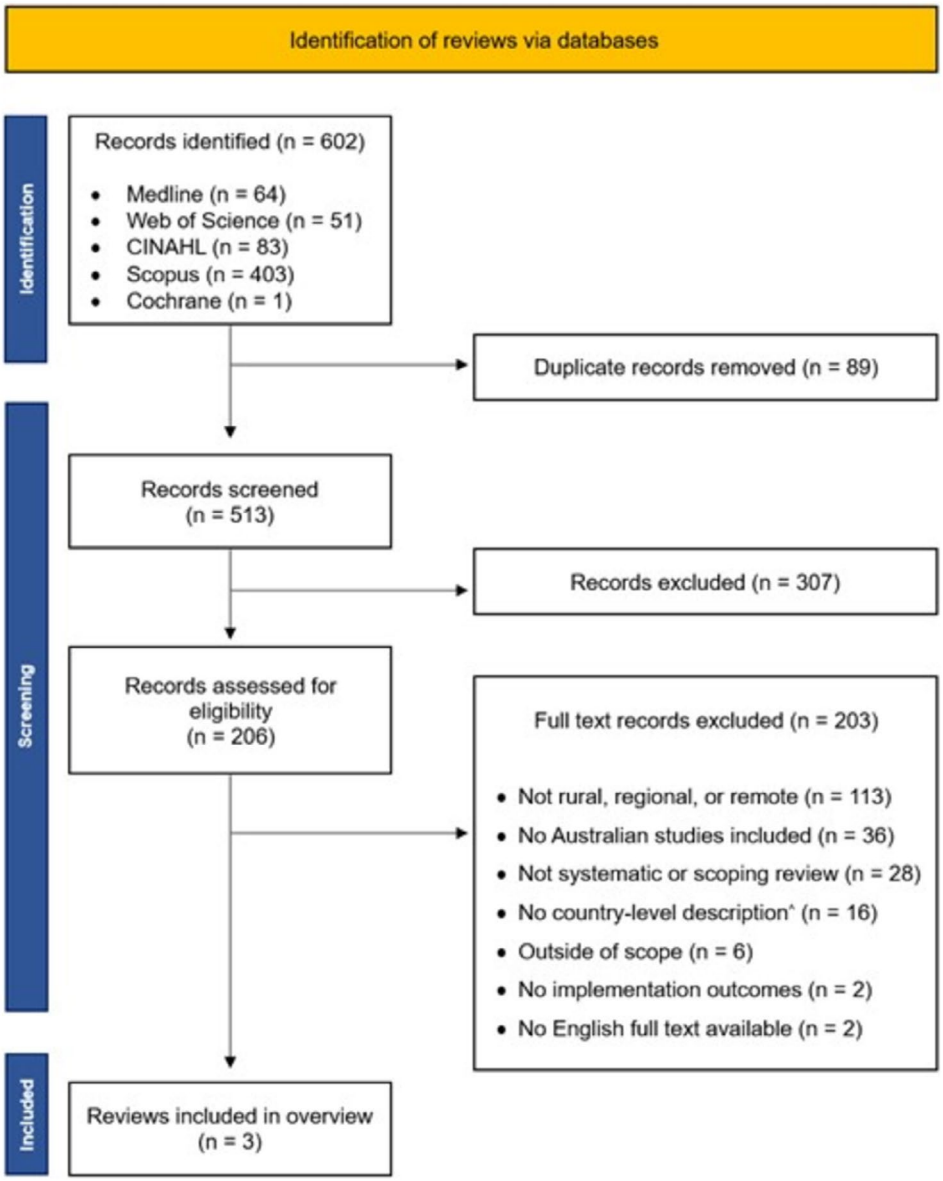

FIGURE 2 | Preferred Reporting Items for Overviews of Reviews (PRIOR) flow diagram of study selection.

an overall quality rating (high, moderate, low, and critically low). A meeting was held for discussion and consensus with a third author. Since the aim of this review was to describe and synthesise a body of qualitative literature rather than determine effect size, reviews were not excluded based on this criterion.

2.5 | Data Collection and Analysis

A data collection form was developed to facilitate the extraction of empirical data, comprising a row for each included review and columns designed to describe the studies and categorise the data. Key themes and text segments from each review describing factors that influence the implementation of digital health in RRR Australia were extracted from both the results and discussion sections; these sections provide additional interpretation from the authors, enriching the findings. Data extraction was conducted by R1, with verification of data and coding completed independently by R3.

Following a review of the empirical data that emerged from the results and discussion sections of reviews, all data were coded to the CFIR domains and constructs, which were subsequently identified as barriers to, or enablers of implementation. This process was conducted by one R1 and subsequently reviewed by R3 to ensure accurate coding of all data to the appropriate constructs or categories. Outcomes related to health and implementation (i.e., adoption, implementation, and sustainment) were identified and described narratively [20].

Finally, we used the excel-based CFIR-ERIC matching tool to input implementation barriers defined by the CFIR, to receive recommendations about expert-recommended implementation strategies that may address these barriers [18, 19]. A table that included a list of ERIC-endorsed strategies was produced, ordered by the number of barrier constructs for which the strategy was a level 1 strategy, and then by the number of level 2 strategies. These review findings were also synthesised into two online visualisations using kumu.io.

3 | Results

3.1 | Study Selection

The initial literature search revealed a total of 513 unique citations. After duplicates were removed and titles and abstracts screened, 206 full-text articles were reviewed. After full-text screening, three articles were identified that met the criteria for inclusion [28–30] (Figure 2). The level of agreement with the titles and abstracts independently screened was 84%, and for full texts was 98%.

3.2 | Characteristics of Included Reviews

The study characteristics of the included reviews are summarised in Table 2. All three papers are systematic reviews published in 2014 and 2016. In reviewing the primary studies, only six studies (3.89%) are included across multiple reviews, particularly those by Banbury et al. [28] and Bradford et al. [29]. Two reviews exclusively focused on studies conducted in Australia [29, 30], and one had an international scope [28], with the majority being Australian studies (70%) alongside comparable OECD countries. All reviews focused on the implementation of digital health in RRR settings and were written in English. All reviews were concentrated on telehealth, and one also included remote monitoring technologies, albeit another form of telehealth (i.e., tele home care, telemedicine, mobile telehealth, and telepsychiatry services) [28]. The review by Jang-Jaccard et al. [30] focused on primary studies that described or discussed barriers to telehealth adoption in rural and remote health in Australia from the perspectives of government, application developers and providers, health professionals, and patients, whereas the review by Bradford et al. [29] presented characteristics of telehealth services, such as aspects like personnel, clinical features, geographical location, service purpose, and factors influencing the success and sustainability. The review by Banbury et al. [28] explored the application of telehealth and remote monitoring technologies as related to access to services, professional development, and implementation in rural and remote locations. This was specific to maternal and child health, First Nations Australians health, mental health, and oral health population groups. The methodological reporting quality of all three systematic reviews was assessed as critically low using the AMSTAR 2 tool (see Supporting Information 2). The domains in which the reviews performed poorly on quality criteria were data extraction, funding source, and risk of bias in included studies. The only domain met by all three reviews was study selection.

The included reviews did not extensively detail health outcomes. One review [29] described services provided from tertiary public hospitals to regional hospital facilities, covering 22 clinical specialities delivered by urban-based specialists, general practitioners, or community nurses to remote locations. Mental health services were the focus in 16 out of 20 studies reviewed, with Banbury et al. identifying digital health services for mental health, as well as neurology, age-related diseases, end-of-life care (including palliative care, dementia, and advanced care planning), and First Nations health. They highlighted outcomes related to improved access to services and enhanced clinical decision-making. Determinants of implementation were characterised by enhanced access to and equity in care, reduced travel and financial barriers for patients, community engagement and culturally appropriate tools, and improved patient-centred care. Adoption focused on increased healthcare access, efficiency, patient experience, care through specialist consultations, professional development opportunities, and quality and safety of services. Sustainment relied on better patient outcomes and quality of life, reduced strain on resources, localised care, support for healthcare professionals, culturally appropriate tools, and financial support.

3.3 | Factors That Influence Implementation

All data were successfully categorised into the five CFIR domains and 21 constructs; 16 constructs, spanning all five domains, were categorised as barriers to implementation, and 12 spanning four of the CFIR domains were identified as enablers. Many of the constructs were categorised as both a barrier and an enabler to the implementation of digital health in RRR settings (Figure 3). The inner setting domain contained the greatest number of barriers and enablers.

The most reported barrier constructs were 'policies and laws', 'structural characteristics' (IT and work infrastructure), and 'compatibility', while the most reported enabler constructs were 'relative advantage', and 'engaging' (key stakeholders, deliverers, and recipients). The CFIR-based framework generated from this study is detailed in Supporting Information 3 and briefly described below.

3.3.1 | Innovation Characteristics

Two barriers and four enablers were identified within five of the eight CFIR constructs related to the characteristics of innovation. The most commonly cited influencing factor was the 'relative advantage' of digital health compared to alternative solutions. All three reviews highlighted the potential benefits of digital health in various settings. For example, telemedicine and tele-homecare were noted to significantly enhance the management of chronic conditions by enabling effective monitoring and improving patients' quality of life [28]. Emergency mental health assessments conducted via videoconference were also reported to provide crucial access to specialised care, reducing the need for inpatient admissions. Overall, digital health in RRR settings was generally perceived as offering advantages over existing programs or services.

In contrast, the quality and validity of the 'evidence base' supporting digital health were characterised by both barriers and enablers. One review [28] acknowledged the limited availability of high-quality studies providing conclusive evidence for services such as home-based digital interventions. However, it also recognised strong evidence supporting digital health applications in mental health, oncology, geriatrics, wound care management and paediatric services. More recent advancements and emerging research further contribute to a growing body of evidence demonstrating a high level of concordance between digital and traditional healthcare services [32]. The absence of adverse outcomes in comparison to

TABLE 2 | Summary details of included studies.

Reference	Date range of included studies	Databases searched	Country of origin (*n* studies)	Setting	Population (sample size)	Digital health	Quality[a]
Banbury et al. [28]	2002–2013	11	Australia (14) Canada (2) International (2) USA (2)	Rural health service organisation and administration; Medically underserved areas; Rural population statistics	Nurses, patients, local government, children, emergency department staff (18357)	Telehealth and remote monitoring	Critically low
Bradford et al. [29]	1988–2015	3 + grey literature	Australia (116)	Health services operating from tertiary public hospitals into regional hospital facilities; Urban-based specialists, general practitioners and community nurses providing telehealth to other locations	Adults, children, older adults, health practitioners, First Nations Australian children, and adults (not reported)	Telehealth	Critically low
Jang-Jaccard et al. [30]	1999–2012	4 + existing review [31]	Australia (18)	Health services delivering telehealth in rural and remote areas of Australia	Stakeholder groups included government, application developers and providers, rural health professionals, rural patients, family and community (not reported)	Telehealth	Critically low

[a]Methodological quality assessed using AMSTAR-2, where critically low = more than one crucial flaw with or without non-critical weaknesses.

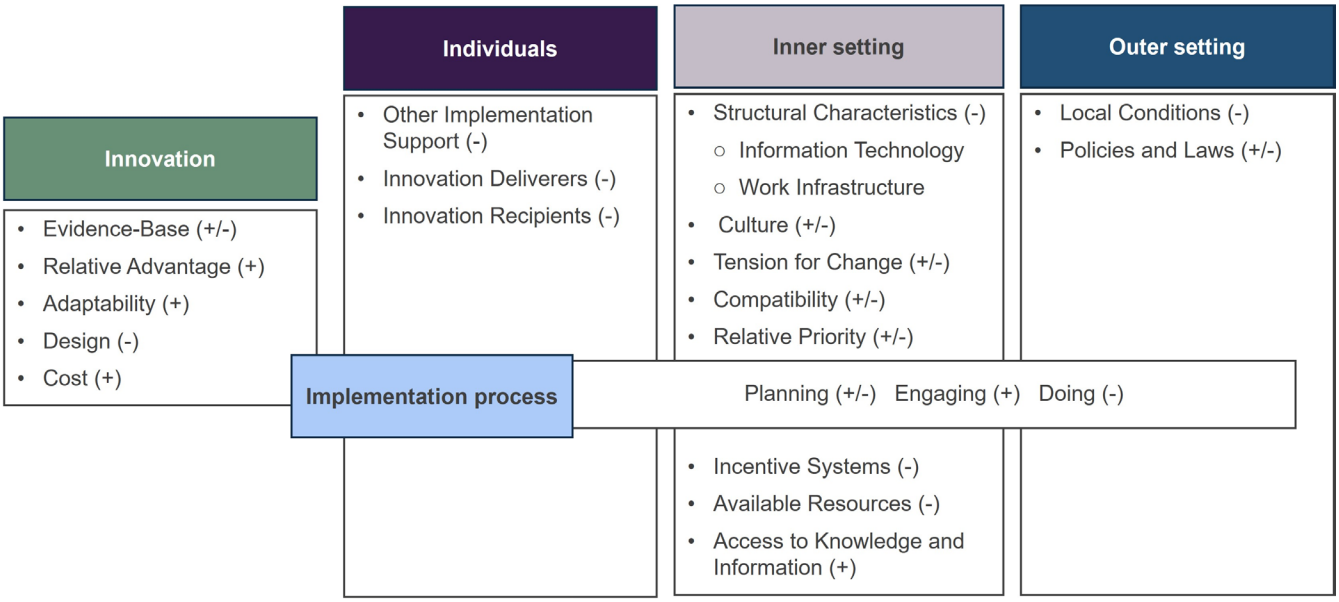

FIGURE 3 | Barriers and enablers to the implementation of digital health in RRR Australia, as mapped to the CFIR domains and constructs; where (–) is a barrier, (+) is an enabler, and (+/–) is both an enabler and a barrier.

in-person consultations, alongside alignment with conventional methods, lends support to the efficacy of remote healthcare services, though further high-quality research is needed to strengthen these conclusions.

3.3.2 | Individual Characteristics

Three barriers related to individual characteristics were identified within this CFIR construct, including 'innovation recipients', 'innovation deliverers', and 'others involved' in supporting implementation. The findings suggest that the effective deployment of telehealth services in RRR areas may be hindered by factors such as financial constraints, insufficient infrastructure, and low health literacy among recipients. Specific challenges highlighted include the unaffordability of necessary equipment, inadequate connectivity, and limited health awareness and computer proficiency. Innovation deliverers also faced difficulties, such as concerns over a perceived loss of control over patient interactions and some mistrust regarding the collaborative nature of telehealth. Additionally, the lack of local IT professionals and service providers to support the implementation and ongoing maintenance of digital health services was noted as an obstacle. Notably, no enablers related to individual characteristics were identified in the included reviews.

3.3.3 | Inner Setting

Seven barriers and five enablers were identified across eight CFIR constructs of the inner setting. The findings suggest that the effective implementation of digital health may be challenged by multiple compatibility issues within the immediate health sector setting (i.e., how the innovation fits with existing workflows, systems, and processes). Healthcare professionals often showed reluctance to transition from traditional methods to digital practices, highlighting the need for solutions that align with established clinical practices and workflows. Additionally, digital health offerings must be culturally sensitive and aligned with local practices to increase acceptance in rural communities. Structural characteristics of the inner setting, such as 'work infrastructure', were also identified as a barrier to implementation. These included frequent staff turnover, increased workloads without adequate resources, a shortage of healthcare workers, scarcity of local expertise, and time constraints for training. Concerns regarding the reliability of IT infrastructure, particularly around internet connectivity and data privacy, were also noted.

The predominant enabler within the inner setting was the construct of 'culture', specifically recipient and learning centredness. This relates to shared values focused on the welfare of recipients, as well as a commitment to psychological safety, continuous improvement, and data-informed practice. The findings suggest that digital health may effectively meet client and carer needs, with indications of high satisfaction levels and improvements in care quality. Digital health also enhances patient confidence in self-management, potentially boosting self-efficacy. Furthermore, the availability of professional development activities, along with opportunities for learning, networking, and collaboration, could enrich the organisational learning environment, contributing to a positive climate for ongoing learning and development.

3.3.4 | Outer Setting

Two CFIR constructs of the outer setting were identified, including two barriers and one enabler, with the construct of 'policies and laws' being most prominent. The reviews highlighted several factors related to policy settings and governance that could impact the implementation and expansion of telehealth services. Consistent government funding and strategic policies are essential to incentivising rural healthcare practice and

supporting telehealth adoption. However, the lack of harmonised regulations across Australian states and territories appears to complicate collaboration and affect licensing, which presents challenges to implementation.

Two reviews noted that Medicare's limited recognition of telehealth services may restrict subsidies, which make it more difficult for providers to deliver or expand telehealth offerings, particularly in rural areas. Privacy concerns related to patient-controlled electronic health records (such as My Health Record), along with the absence of clear malpractice laws, were also raised as potential barriers to adoption. The lack of established professional standards for telehealth also complicates integration into existing healthcare practices, suggesting the need for more robust regulatory frameworks and clearer guidelines to facilitate broader uptake.

3.3.5 | Implementation Process

The factors influencing the implementation process and its associated constructs were not widely described in the included reviews. Three barriers and three enablers were identified, spanning four CFIR constructs, and were related to the activities and strategies used to implement the innovation. The predominant construct identified was 'engaging', which served as both a barrier and an enabler.

Local clinician champions were highlighted as playing a pivotal role in advocating for and facilitating the adoption of digital health. They supported health professionals by encouraging consultation with experts across various fields and employing effective communication strategies to engage both clinicians and patients, which seemed to lead to increased involvement from healthcare providers and patients. The success of digital health also appeared to be supported by community consultation and ongoing engagement, which helped to address workforce instability and ensured that both clinicians and patients were actively involved throughout the implementation process. However, one barrier to engagement was the frequent staff turnover in rural practices, which seemed to make it difficult to maintain consistent use of telehealth services over time.

3.4 | Implementation Strategies Matched to Barrier Constructs

The ERIC implementation strategies mapped to identified CFIR constructs endorsed as level 1 strategies for at least one identified barrier construct are as follows: (1) conduct local needs assessment, (2) identify and prepare champions, (3) alter incentive/allowance structures, (4) involve patients/consumers and family members, (5) develop a formal implementation blueprint, (6) obtain and use patients/consumers and family feedback, and (7) access new funding (Supporting Information 4). The barrier constructs with the most level 1 strategies were 'patient needs and resources' ($n = 3$), and 'planning' ($n = 2$). Strategies could not be mapped to constructs listed in the 'individual characteristics' domain, as these were introduced in the updated CFIR framework. Table 3 details the top recommended strategies for addressing barriers to the implementation of digital health in RRR Australia with examples of tailored approaches at different stages of implementation.

4 | Discussion

This overview of reviews highlights numerous factors essential for the effective implementation of digital health in RRR settings, with no single factor emerging as a predominant barrier or enabler. However, the influencing factors were notably consistent and could be comprehensively explained using the CFIR framework, with strategies to mitigate barriers also generated. To our knowledge, this is the first study to apply the CFIR to identify influencing factors and to use the CFIR-ERIC matching tool to offer potential strategies that may assist in facilitating the implementation of digital health in RRR Australia. The findings from this overview of reviews are available as two online maps (see: https://shorturl.at/ak8n2), which allow users to further explore the key influencing factors and evidence-based implementation strategies discussed in this paper.

Evidence from the field of implementation science highlights the importance of contextualising innovations to the environments in which they are applied [33–35]. Our review identified influencing factors across all CFIR domains; however, the most prominent barriers and enablers were found within the 'inner setting' domain. While each of the five CFIR domains plays a part in implementation, the inner setting domain relates to the organisational, social, and environmental context in which the innovation is implemented. From our analysis, this includes healthcare delivery environments such as regional hospitals, rural health services, and outreach clinics, which involve multiple operational levels (e.g., teams or departments) and interact with different constructs. In particular 'structural characteristics' (i.e., size, type, staff, location) and 'culture' (i.e., values, beliefs, norms) reflect enduring and intrinsic aspects of the inner setting, while 'compatibility' is a dynamic construct directly related to the implementation of specific innovations [36–38]. Compatibility, frequently cited as a barrier, relates to the degree to which digital health aligns with existing organisational workflows, systems, and processes—often referred to as interoperability [39, 40]. This construct is integral for the sustained success of an innovation and requires a strategic fit with the organisation's values and existing work practices. An illustrative example from one of the reviews highlights the importance of these elements. In the case of a mobile ear-screening service implemented in a First Nations community in Central Queensland [41], several key inner-setting factors contributed to the initiative's success. Firstly, the leadership and active involvement of local First Nations health workers were essential for providing culturally sensitive care and building trust within the community. Secondly, the use of telemedicine systems to connect community-based screening services with a tertiary children's hospital facilitated efficient referral pathways and specialist consultations, enabling high-quality care at a distance. Thirdly, local schools served as screening sites, demonstrating the effective integration of healthcare services into existing community structures. Finally, collaboration between local health services and the tertiary hospital ensured seamless interactions between local expertise and specialist knowledge, supported by shared goals and resource allocation. Collectively, these factors created an inner setting that supported the successful implementation of digital health.

TABLE 3 | Top recommended strategies for addressing barriers to the implementation of digital health in RRR Australia with examples of tailored approaches at different stages of implementation (i.e., before, during and after). Examples should be contextualised to the specific innovation being introduced.

#	Recommended strategy[a]	Description	Implementation stage		
			Before ➡	During ➡	After
1	Conduct local needs assessment	Collect and analyse data related to the need for the innovation	Organise preliminary meetings and consultations with stakeholders[b] to establish trust and identify shared goals	Establish a continuous feedback loop by setting up regular check-ins with stakeholders[b] to gather feedback and make necessary adjustments to the innovation	Work with local healthcare leaders and policymakers to develop a sustainability plan, including securing ongoing funding and training, to maintain and scale
2	Identify and prepare champions	Identify and prepare individuals who dedicate themselves to supporting, marketing, and driving through an implementation, overcoming indifference or resistance that the intervention may provoke in an organisation	Identify and recruit local champions who understand the specific challenges of rural and remote healthcare and provide them with targeted training and resources	Involve these champions actively in the rollout process, providing them with support and regular updates	Offer ongoing professional development and recognition to maintain their engagement and ensure their continued support
3	Alter incentive/ allowance structures	Work to incentivise the adoption and implementation of the clinical innovation	Review and adjust incentive structures to better align with the needs and motivations of stakeholders[b] in rural and remote settings	Implement these revised incentives and monitor their impact on provider engagement and performance	Regularly review and refine incentive structures based on feedback from rural and remote healthcare providers and performance data
4	Involve patients/ consumers and family members	Engage or include patients/ consumers and families in the implementation effort	Establish advisory groups consisting of patients, consumers, and family members locally to provide input	Actively involve these groups in the implementation process to ensure it meets their needs and are integrated effectively into their care	Continue to engage patients, consumers, and family members for ongoing feedback and improvements
5	Develop a formal implementation blueprint	Develop a formal implementation blueprint that includes all goals and strategies	Draft a detailed implementation plan that includes timelines, responsibilities, and resources specifically for the settings	Execute and track progress against the plan, adjusting as necessary to fit local conditions	Regularly review and update the blueprint to ensure it remains aligned with project goals and adapts to any changes in the rural and remote context
6	Obtain and use patients/ consumers and family feedback	Develop strategies to increase patient/ consumer and family feedback on the implementation effort	Set clear expectations with patients, consumers, and families about how their feedback will be used to shape the implementation process, ensuring they feel involved and valued from the outset	Communicate any changes made based on feedback, showing that their input is being actively considered and used to improve the service	Share results with patients, consumers, and families, and the wider community to demonstrate transparency and responsiveness

(Continues)

TABLE 3 | (Continued)

#	Recommended strategy[a]	Description	Implementation stage		
			Before	During	After
7	Access new funding	Access new or existing money to facilitate the implementation	Seek early engagement with stakeholders[b] to gain support and secure financial commitments	Regularly assess whether the allocated resources are effectively supporting the implementation, such as covering necessary training, materials, or logistical support	Develop a sustainability plan that outlines ongoing funding needs for maintaining the service and accessing future resources. Explore additional funding streams for long-term operation

[a]Strategies generated by the CFIR-ERIC matching tool (18).
[b]Stakeholders might include local health providers or teams, clinicians, community leaders, health workers, patients, government bodies, funding organisations (or a combination).

A whole-of-government approach is needed to ensure that the necessary infrastructure, policies, and workforce strategies are in place to support the full functionality of digital health in RRR locations [42]. Beyond the health sector, this requires coordinated efforts across multiple levels of government to address key enablers such as digital infrastructure, ensuring reliable broadband and mobile connectivity; education and workforce development, supporting healthcare professionals through digital health training and upskilling; and social services, integrating digital health with aged care, disability, and mental health services to enhances accessibility and continuity of care. The nature of RRR healthcare settings requires a diverse skill set and knowledge applied in geographically and professionally isolated environments. High turnover rates among healthcare workers result in a loss of critical knowledge and resources, exacerbating inconsistencies in treatment, lack of follow-up, and a reliance on costly patient transfers to regional hospitals [43]. These challenges align with the barrier construct of 'structural characteristics—workflow infrastructure', where workforce instability and workflow disruption are major concerns. However, the most commonly reported innovation characteristic was the growing perception that digital innovation was better than alternative innovation or current practice (i.e., relative advantage). For example, telehealth has been shown to enable chronic disease management, enhance geriatric care by allowing older adults to remain at home, and expand access to specialist mental health services through emergency videoconferencing [28]. As digital health continues to evolve in RRR locations, a comprehensive, cross-sectoral approach will be essential to maximising its impact and sustainability.

Based on the implementation strategies identified in this study (Table 3), successfully implementing digital health initiatives requires a focus on several key areas. First, stakeholder engagement and collaboration, with active involvement from patients, consumers, families, and local champions, are essential to ensure that their feedback shapes the implementation process. Second, a thorough contextual understanding, achieved through local needs assessments, helps align the intervention with the specific challenges and resources of the community, making it more relevant and effective. Third, planning and structuring implementation through a formal implementation blueprint provides a clear, organised framework to guide the process. Finally, resource mobilisation and support are essential, requiring adjustments to incentive structures and securing new funding to sustain the implementation and ensure long-term financial and motivational backing. This approach presents an opportunity to determine which strategies are most effective for improving the implementation of digital health in RRR Australia; not all strategies may be effective in addressing these barriers depending on the specific project or context. A crucial next step is to identify which strategies can most effectively and efficiently address different barriers simultaneously and across various settings. To facilitate this, it is important for innovation collaborators or project teams to consider barrier mitigation and conduct strategy mapping. This approach will support a structured method for overcoming barriers and applying implementation strategies in a practical manner. Specifically, it is necessary to define the scope of each strategy, map strategies to objectives, and understand their relationship to underlying mechanisms. As suggested by Shin et al.

[44], developing a logic model that incorporates these elements will aid in preparing for the implementation of selected strategies and measuring their success in addressing the identified barriers.

A strength of this study is the utilisation of the CFIR framework, which enhances comparability with other implementation studies and supports the use of standardised terminology in this field. While the CFIR-ERIC matching tool is a relatively new guide, the effectiveness of this tool in producing truly effective strategies has yet to be thoroughly evaluated. The generalisability of our study findings is constrained by several factors: the small number of included reviews, their predominant focus on telehealth rather than a broader range of digital health technologies, and the age of the reviews, most of which were published nearly a decade ago, prior to the widespread digital transformation driven by the pandemic. Despite these limitations, many of the identified influencing factors and implementation strategies remain relevant today, though they should be considered within the context of current technological and healthcare advancements. Collectively, these points highlight both the paucity of research in this field and the need for an updated systematic review of digital health implementation in RRR Australia.

The findings from this study provide valuable insights to guide digital health implementation efforts and identify areas for future research. Despite their lower quality rating, it is important to note that these reviews still provide valuable insights into digital health implementation in RRR Australia. Researchers, healthcare professionals, and organisations seeking to design or implement digital health initiatives can leverage these insights to strategically allocate funding and prioritise areas that will enhance their implementation efforts. The results can be integrated into both existing and future digital health programmes, with a focus on addressing key barriers and enablers that are likely to impact implementation in practical settings and continuing implementation studies to evaluate innovation outcomes. It is important to recognise that, since the publication of the reviews included in this study, a considerable body of research and development has emerged, particularly in response to the digital transformation accelerated by the COVID-19 pandemic. Despite a comprehensive search using predefined criteria, only three reviews met the inclusion criteria for this overview. While additional studies on digital health implementation in rural areas exist, they did not align with the specific focus and/or relevant implementation outcomes aligned with this overview of reviews. Additionally, we recognise the value of grey literature and acknowledge that it may provide insights into ongoing research and emerging trends. However, grey literature was outside the scope of this study, as our focus was on synthesising evidence from peer-reviewed systematic and scoping reviews that meet established methodological standards. Nevertheless, our findings contribute to this evolving field by identifying influencing factors and proposing implementation strategies to overcome barriers. This allows future research to assess the consistency of these factors across diverse implementation contexts and to evaluate whether modifying these key determinants can positively impact implementation outcomes.

5 | Conclusion

This overview of reviews identifies key barriers and enablers shaping digital health implementation in RRR Australia. Despite the limited number of reviews, they provide a nuanced understanding of factors influencing implementation across all five CFIR domains and most constructs. This not only highlights the complexity of implementation in RRR settings, but also the need for multi-level strategies. Enhancing contextual understanding, tailoring interventions, fostering local leadership, and prioritising advocacy and stakeholder engagement can strengthen implementation efforts and should be central to future digital health implementation in RRR Australia.

Author Contributions

Michelle A. Krahe: conceptualisation, investigation, data curation, formal analysis, visualisation, writing – original draft, writing – review and editing. **Stephanie Baker:** ocnceptualisation, data curation, writing – review and editing. **Leeanna Woods:** conceptualisation, data curation, formal analysis, writing – review and editing. **Sarah L. Larkins:** conceptualisation, funding acquisition, writing – review and editing.

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Ethics Statement

The authors have nothing to report.

Conflicts of Interest

Author Leeanna Woods would like to disclose her conflicts of interest, as a guest Editor for this special issue.

Data Availability Statement

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.