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Technopreneurship in Chronic Disease Nursing: A Systematic Review of Digital Innovations Enhancing Patient Management and Care

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A B S T R A C T
Chronic diseases such as diabetes, cardiovascular conditions, and cancer require ongoing nursing care and patient self-management. Technopreneurship, combining technological innovation with entrepreneurship, offers digital solutions for chronic disease nursing, though systematic evidence remains limited. This systematic review, guided by PRISMA 2020 and Cochrane protocols, searched PubMed, ScienceDirect, Scopus, and Wiley Online for randomized controlled trials (RCTs) from 2019–2025. Eligible studies included nurse-led or nurse-involved digital interventions for adults with chronic diseases. Fourteen high-quality RCTs met inclusion, assessed using the JBI Critical Appraisal Checklist. Studies (sample sizes 45–559) were conducted in countries such as the USA, China, Hong Kong, France, Turkey, Singapore, and Australia. Interventions included mobile applications, telemonitoring, eHealth platforms, web-based education, and hybrid care. Findings showed improved adherence, symptom control, quality of life, clinical indicators, nursing efficiency, and patient engagement. Despite promising results, small samples, short intervention periods, and context-specific populations limit generalizability. Technopreneurship-driven innovations enhance personalized, continuous, and accessible care. Future research should explore large-scale, long-term trials to ensure sustainability and wider adoption.

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INTRODUCTION

Chronic diseases such as diabetes, cardiovascular disorders, and COPD present long-term challenges that demand continuous care and patient engagement (1). Nurses play a crucial role in managing these conditions through education, monitoring, and coordination. However, traditional care systems are increasingly insufficient in addressing the complexity and scale of chronic care needs (2). In response, technopreneurship—combining technological innovation with entrepreneurial thinking—has emerged as a powerful approach to develop digital tools that support self-management, remote monitoring, and more personalized nursing interventions (3). Despite its growing relevance, there remains a lack of systematic evaluation of how technopreneurship contributes to improving patient outcomes in chronic disease nursing, highlighting the need for a comprehensive review.

This study is grounded in the intersection of innovation diffusion theory (Rogers, 2003) and nursing informatics, both of which provide conceptual frameworks to understand how technological solutions are adopted, utilized, and scaled within clinical practice (4). Innovation diffusion theory emphasizes the characteristics of adopters, the innovation itself, and communication channels—factors crucial for understanding how digital nursing solutions spread (5). Nursing informatics, on the other hand, supports the integration of nursing science with information and analytical sciences to manage and communicate data, information, and knowledge in nursing practice (6). In this context, technopreneurship can be viewed as a catalyst that enables nurses to bridge theoretical nursing care models with technological innovation to achieve evidence-based, patient-centered outcomes.

The international relevance of technopreneurship in chronic disease nursing is reflected in global health priorities. Both the World Health Organization (WHO) and the International Council of Nurses (ICN) have highlighted the critical role of digital health innovations in achieving universal health coverage and addressing the burden of non-communicable diseases (NCDs) (7). High-income countries have shown significant advancements in digital nursing platforms and chronic care models, yet low- and middle-income countries are rapidly catching up due to the accessibility of mobile technologies and increasing digital literacy among health professionals (8). A globally informed systematic review is thus essential to capture diverse practices, challenges, and opportunities, and to guide evidence-based policies and professional development across regions.

Given the growing integration of digital technologies in chronic disease management and the entrepreneurial role emerging among nurses, a systematic synthesis of current evidence is crucial. The aim of this systematic review is to identify, evaluate, and synthesize digital innovations developed or applied through technopreneurship that contribute to enhanced management and care of patients with chronic diseases in nursing contexts. The objectives of this review to explore the role of technopreneurship in facilitating the adoption and sustainability of these innovations.

METHODS

Design

A systematic review was designed and implemented following Cochrane Collaboration protocols and Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement Flow Diagram (9) (Figure 1).

Search Methods

This study used the PICO model to comprehensively outline the various components associated with the identified problem (P)- Patients with chronic diseases receiving nursing care, and/or nurses involved in chronic disease management; (I)- Implementation or development of digital innovations driven by technopreneurship (e.g., mobile apps, wearable devices, telemonitoring tools, AI-based nursing platforms); (C) Conventional or non-digital nursing care approaches, or absence of technopreneurial innovations (O)- Improved patient management outcomes (e.g., adherence, symptom control, quality of life), enhanced nursing efficiency, and increased patient engagement.

The literature databases were searched from Pubmed, ScienceDirect, Scopus, and Wiley Online using the following keywords: ("Chronic Disease/nursing"[MeSH] OR "Chronic Disease/therapy"[MeSH]) AND ("Nursing Care"[MeSH] OR "Nurse's Role"[MeSH]) AND ("Telemedicine"[MeSH] OR "Mobile Applications"[MeSH] OR "Remote Consultation"[MeSH]) AND ("Entrepreneurship"[MeSH] OR "Innovation"[MeSH]) AND ("Self-Management"[MeSH]) AND ("Patient Care Management"[MeSH]). The search was limited to "title/abstract" before proceeding to a full-text evaluation.

Search Outcome

The literature search yielded 1,812 relevant articles from Pubmed, ScienceDirect, Scopus, and Wiley Online. Inclusion criteria included studies that evaluated technopreneurship-based digital innovations in chronic disease nursing practice in adult patients. Studies had to involve interventions such as mobile apps, telemonitoring, or other digital tools that were nurse-led or involved. Included research types include quantitative studies published in English-language journals within the last 5 years, with a focus on patient management outcomes, clinical outcomes, or patient satisfaction. Exclusion criteria: non-primary sources such as study design comments, editorials, and dissertation papers were excluded (Figure 1).

Selection of Studies

All research types were exported to the Mendeley reference manager. The titles and abstracts of all articles reported chronic disease nursing practice in adult patients involving interventions such as mobile apps, telemonitoring, or other digital devices that were nurse-led or involved.

The articles were also checked for duplicate articles or studies, published from 2019 to 2025. Subsequently, 14 articles were retrieved that addressed the PICO and inclusion criteria with the final decision based on author consensus (Table 1).

Quality Appraisal

This study performed the methodological quality of the articles utilizing the JBI Critical Appraisal Checklist for RCT. The scale consists of 13 questions that were assessed for risk of bias in the method of studies. And rated the quality of the studies based on a comprehensive explanation of the background, and a satisfactory statistical examination was conducted. Next, the articles that obtained scores of 13/13, 12-9/13, and less than 8/13 were categorized as high, moderate, and low quality, respectively. Consequently, 14 studies were of high methodological rigor as allof these research papers received a "yes" evaluation. All the studies in the review focused on questions using appropriate research methods.

Data Abstraction

The data abstraction sheet was developed using an Excel table.

Data Analysis/Synthesis

The authors recorded the author, year of publication, country of origin, purpose, research design, sample size, research methods, results, and limitations of the selected articles (Table 2). Finally, the selected articles were categorised into four main themes of job satisfaction: digital innovation in chronic disease nursing, role of technopreneurship in health solution development, impact of digital innovation on patient management, and improving quality of care and patient satisfaction.

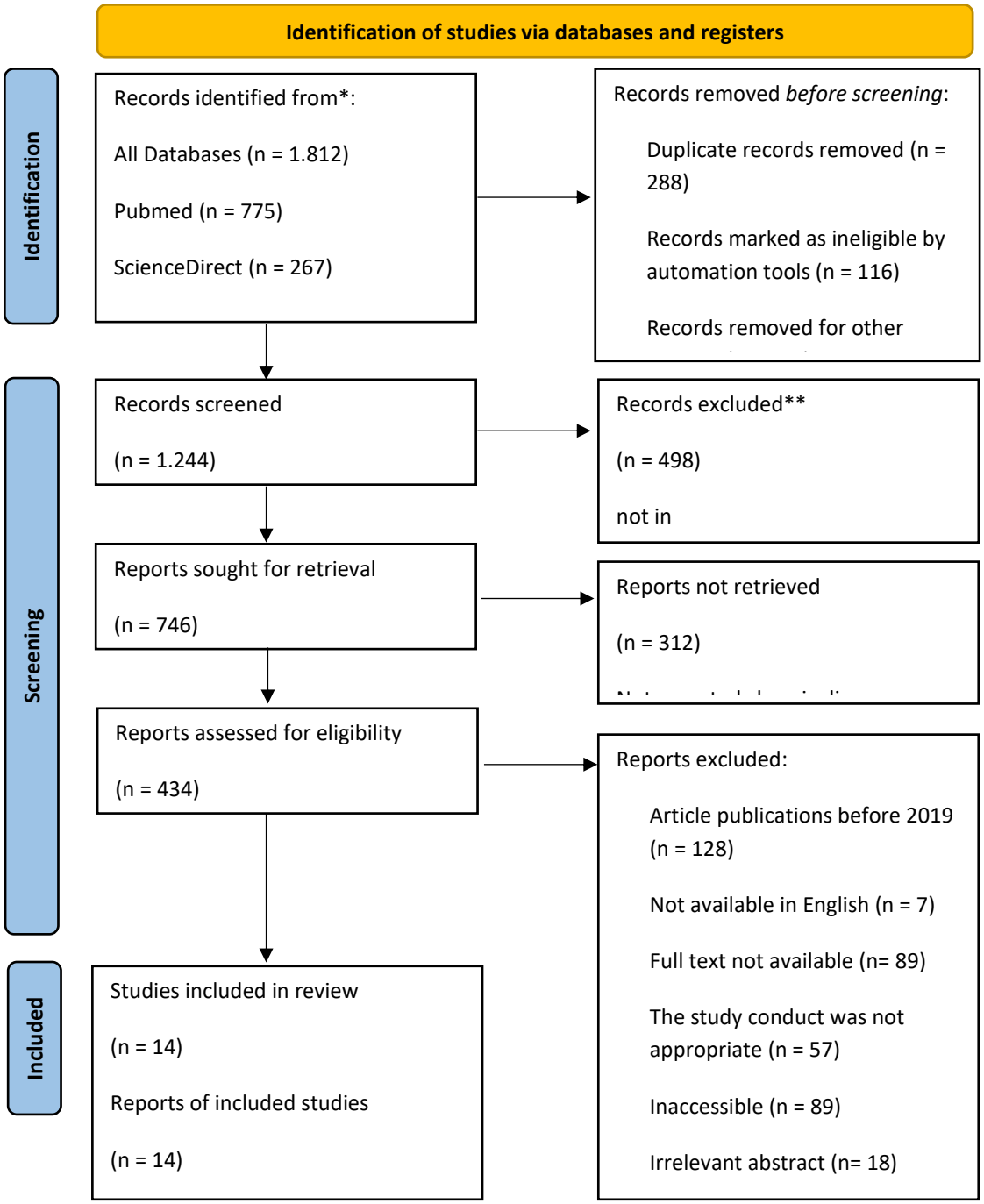

Figure 1. PRISMA 2020 Flow Diagram

Table 1: JBI Critical Appraisal Checklist for Analytical RCT Studies

	Or	Lee	Arad	Egede	Jiang	Lyu	Metilda	Mir	Mumcu	Pakrad	Parker	Simsek	Su	Wong
	2020	2025	2021	2024	2021	2021	2021	2022	2022	2021	2022	2023	2021	2022
1.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2.	Unclear	Unclear	No	Unclear	Yes	Unclear	No	Unclear	Unclear	Yes	Unclear	Unclear	Yes	Unclear
3.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5.	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6.	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes
9.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
11.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
13.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Overall appraisal:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

RESULTS

Table 2: Analysis of Studies Included in the Review

Authors, Country	Aim	Study Design, Sample Size	Methods	Results	Limitations
(10). Hongkong	Testing the effectiveness and safety of Technology Surrogate Nursing (TSN) in patients with type 2 diabetes and hypertension	RCT N= 299 Patients	TSN tablet application	Improvement in glycaemic control (HbA1c), safety indication of TSN, not significant on blood pressure	No significant difference in blood pressure; limitations in technology calibration and intervention duration
(11). New Zealand	Comparing traditional vs hybrid cardiac rehabilitation based on continuous care model in post-CABG patients	RCT N= 88 Patients	Hybrid cardiac rehabilitation with remote follow-up	Improved quality of life, functional capacity, reduced readmissions; increased patient engagement through biweekly communication	Sample size limited; no no-rehabilitation group due to ethical reasons
(12). Iran	Assess the effect of patient education and nurse-led telephone follow-up on haemodialysis therapy adherence.	RCT N= 66 Patients	Nurse-led telephone follow-up	Improved haemodialysis therapy adherence in the dimensions of attendance, medication, diet, fluid; improved patient engagement	Small sample size; limited follow-up

Authors, Country	Aim	Study Design, Sample Size	Methods	Results	Limitations
(13). USA	Assessing the effect of technology-based case management on blood pressure control and quality of life in low-income diabetic patients	RCT N= 113 Patients	Telehealth	Improved diastolic blood pressure control without reducing quality of life; improved nursing efficiency through remote management	Limited to rural and ethnically specific populations; duration 6 months
(14). Singapore	Assessing the effectiveness of a nurse-led home-based self-management programme for chronic heart failure.	RCT N= 213 Patients	Nurse-led home-based	Improved self-care adherence, self-efficacy, quality of life, reduced hospitalisation (enhanced nursing efficiency and patient engagement)	Differences between intervention groups A and B were not significant; limited urban setting
(15). China	Assess the effect of a web-based transitional care programme on glycaemic control and quality of life in post-hospital type 2 diabetes patients	RCT N= 116 Patients	web-based transitional care programme in diabetic patients	Improved glycaemic control (HbA1c), quality of life, mediated by self-efficacy and adherence	Relatively short duration of intervention; limited population of one region

Authors, Country	Aim	Study Design, Sample Size	Methods	Results	Limitations
(16). India	Assess the effectiveness of mobile app-based discharge teaching in postoperative neurosurgery patients	RCT N= 100 Patients	Mobile app-based	Improved adherence to discharge instructions, patient satisfaction (engagement); effectiveness of medication adherence varied	No significant difference in overall medication adherence; limited follow-up
(17). France	Assessing the effect of digital remote monitoring in cancer patients taking oral therapy	RCT N= 559 Patients	Mobile app-based	Improved therapy adherence, reduced toxicities, improved patient experience (quality of life and engagement), reduced hospitalisation days	Limited duration of observation, focus on oral therapy only
(18). Turkey	Assess the effect of web-based education on self-management and family support in women with type 2 diabetes.	RCT N= 61 Patients	Web education	Increased self-care adherence and family support (engagement)	Small sample size, limited to women only

Authors, Country	Aim	Study Design, Sample Size	Methods	Results	Limitations
(19). Iran	Comparing traditional vs hybrid cardiac rehabilitation based on continuous care model in post-CABG patients	RCT N= 88 Patients	Remote follow-up and mobile app	Improved quality of life, functional capacity, reduced readmissions; increased patient engagement through biweekly communication	Sample size limited; no no-rehabilitation group due to ethical reasons
(20). Australia	Evaluation of a multifaceted intervention on diet, physical activity and health literacy in obese patients in primary care	RCT N= 215 Patients	Applifestyle apps and telephone coaching	Small improvement in dietary adherence; no significant change in symptom control and quality of life; low engagement	Low recruitment; small sample; limited generalisability; limited measurement tools
(21). Turkey	Assess the effects of a smartphone-based nursing counselling system on adherence, glycaemic control, and satisfaction of GDM patients	RCT N= 45 Patients	Smartphone counselling	Improved diet and activity adherence; increased satisfaction; glycaemic control not significant	Small sample; short intervention duration; no significant effect on glycaemic control

Authors, Country	Aim	Study Design, Sample Size	Methods	Results	Limitations
(22). China	Assess the effects of a nurse-led eHealth cardiac rehabilitation programme in coronary heart disease patients	RCT N= 146 Patients	eHealth programme	Improved adherence, symptom control, quality of life, and patient engagement; nursing efficiency improved	Limited to one hospital; short duration; no participant blinding
(23). China	Assessing the benefit of nursing interaction in the use of mHealth apps to improve quality of life of community-dwelling	RCT N= 221 Patients	mHealth apps	Improved adherence and physical quality of life in mHealth group; self-efficacy increased in interactive group; higher patient engagement	Short duration of intervention; limited interaction; long-term effects unclear

Characteristics of Studies

The systematic review included 14 randomized controlled trials (RCTs) published between 2020 and 2025, conducted across various countries including Hong Kong, New Zealand, Iran, USA, Singapore, China, India, France, Turkey, and Australia. Sample sizes ranged from 45 to 559 adult patients with chronic diseases such as diabetes, cardiovascular conditions, and cancer. All studies evaluated nurse-led or nurse-involved digital interventions, such as mobile applications, telemonitoring, web-based education, and eHealth programs designed to enhance patient management and care outcomes.

Methodologically, the included studies demonstrated high rigor, as assessed by the JBI Critical Appraisal Checklist for RCTs, with all studies meeting the majority of quality criteria including randomization, blinding where possible, and appropriate statistical analyses. Interventions focused on improving adherence, symptom control, quality of life, nursing efficiency, and patient engagement. While most studies reported significant improvements in these outcomes, limitations included relatively small sample sizes, short intervention

durations, and geographic or population-specific constraints, which may affect generalizability.

The diversity of digital tools and healthcare settings reflects a broad applicability of technopreneurship-driven innovations in chronic disease nursing across different health systems and cultures. The consistency in positive effects suggests that nurse-led digital solutions are effective adjuncts to conventional care, particularly in enhancing self-management and remote monitoring. Nonetheless, further large-scale, long-term studies are warranted to confirm sustainability and to explore implementation challenges in diverse contexts.

Theme 1: Adherence

The reviewed studies consistently demonstrated that technopreneurship-driven digital interventions significantly improved patient adherence to treatment regimens. Nurse-led mobile applications, telemonitoring systems, and remote follow-up programs enhanced medication compliance, attendance at therapy sessions, dietary restrictions, and lifestyle modifications. For instance, interventions such as nurse-led telephone follow-ups and mobile app-based education improved adherence among patients with diabetes, haemodialysis, and gestational diabetes. Despite some variations in sample size and intervention duration, most studies reported statistically significant improvements in adherence behaviors, highlighting the critical role of digital tools in supporting chronic disease self-management.

Theme 2: symptom control

Digital nursing innovations also contributed to effective symptom management in chronic disease patients. Several studies reported improvements in clinical indicators such as blood pressure control, glycaemic levels, and management of cardiac symptoms through nurse-guided telehealth and eHealth programs. While some studies noted modest or non-significant changes in certain parameters (e.g., blood pressure), the overall trend favored better symptom control facilitated by continuous remote monitoring and personalized digital support. These findings suggest that integrating technological solutions with nursing care can enhance clinical outcomes by enabling timely interventions and promoting patient self-awareness.

Theme 3: quality of life

Quality of life improvements emerged as a prominent outcome across the selected studies. Patients engaged in nurse-led digital interventions, including web-based transitional care and mobile health apps, reported enhanced physical, emotional, and social well-being. Programs offering remote rehabilitation and counseling were particularly effective in reducing hospital readmissions and improving functional capacity. Although some studies indicated limited follow-up durations, the positive influence on quality of life underscores the value of integrating technopreneurship innovations in chronic disease nursing to holistically support patient well-being beyond clinical measures.

Theme 4: enhanced nursing efficiency

The incorporation of digital tools in nursing practice demonstrated clear benefits in improving nursing efficiency. Remote monitoring, telehealth case management, and digital platforms reduced the need for in-person visits, allowing nurses to manage larger patient loads more effectively. Studies

highlighted increased efficiency in delivering education, tracking patient progress, and facilitating communication, thereby optimizing nursing workflow and resource utilization. These advancements not only enhance care delivery but also enable nurses to focus on complex patient needs, suggesting that technopreneurship fosters both clinical and operational improvements within nursing practice.

Theme 5: increased patient engagement

Increased patient engagement was a consistent theme linked to the adoption of digital innovations in nursing care. Interactive mobile applications, telecommunication, and web-based programs encouraged patients to actively participate in their health management through self-monitoring, education, and continuous feedback. Enhanced engagement was associated with better adherence and satisfaction, as patients felt more connected to healthcare providers and empowered in decision-making. The studies collectively indicate that technopreneurship facilitates patient-centered care models by leveraging technology to strengthen the nurse-patient relationship and promote sustained involvement in chronic disease management.

DISCUSSION

The findings from this systematic review highlight the broad applicability of technopreneurship-driven digital innovations in enhancing chronic disease nursing care. The consistent improvements in patient adherence, symptom control, quality of life, nursing efficiency, and patient engagement suggest that integrating technology with nursing practice addresses critical gaps in conventional chronic disease management (10,14,23). Theoretically, these results align with the innovation diffusion theory, which underscores the importance of adopter characteristics, communication channels, and perceived benefits in technology adoption within healthcare settings (24). Practically, the deployment of nurse-led mobile apps, telemonitoring, and eHealth programs enables personalized, continuous care that fosters patient empowerment and optimizes nursing resources (13,16). This integration supports evidence-based nursing models by enhancing real-time monitoring and enabling proactive interventions, which are critical for managing complex chronic conditions (25).

Moreover, the diverse geographic contexts of the reviewed studies from high-income countries to middle-income settings demonstrate the transferability of technopreneurship innovations across various healthcare infrastructures (26). This suggests that with adequate digital literacy and technological accessibility, such innovations can be scaled globally to improve chronic disease outcomes and nursing practice efficiency. However, several limitations must be acknowledged. Most studies featured relatively small sample sizes, short intervention durations, and population-specific samples, which may limit the robustness and generalizability of findings (20,21). Additionally, the heterogeneity of digital tools and intervention designs poses challenges for standardized evaluation and implementation. Despite these constraints, the overall high methodological quality of the included randomized controlled trials strengthens the validity of

the evidence. Future research should focus on large-scale, longitudinal studies to confirm sustainability and explore contextual factors influencing adoption and patient outcomes in diverse populations. Despite these constraints, the overall high methodological quality of the included randomized controlled trials strengthens the validity of the evidence. Future research should focus on large-scale, longitudinal studies to confirm sustainability and explore contextual factors influencing adoption and patient outcomes in diverse populations. Notably, the most consistent benefits observed were improved treatment adherence, enhanced patient engagement, and better quality of life, particularly in interventions integrating mobile applications and telemonitoring. These findings indicate that digital nursing innovations are not only supportive tools but also potential game-changers in chronic disease management, enabling proactive, efficient, and patient-centered care.

CONCLUSIONS

This review demonstrates that technopreneurship-driven digital innovations significantly enhance chronic disease nursing by improving patient adherence, symptom management, quality of life, nursing efficiency, and patient engagement. Nurse-led digital tools are effective complements to traditional care, enabling more personalized, continuous, and accessible management of chronic conditions. These findings support the integration of technological entrepreneurship as a strategic approach to optimize nursing care outcomes.

ADVANCED RESEARCH

Despite promising results, this review is limited by the relatively small sample sizes, short duration of interventions, and the geographic concentration of included studies. Variations in digital tools and intervention designs also present challenges in standardizing findings. Additionally, some studies lacked long-term follow-up to assess sustainability. These factors restrict the generalizability of conclusions and highlight the need for further large-scale, diverse, and longitudinal research.

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