

# Digital Advancements In Cardiovascular Nursing: Telemonitoring & Wearables

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## ABSTRACT

**Introduction:** Rapid developments in wearable technologies and telemonitoring are transforming the cardiovascular nursing field. These devices enable continuous vital sign monitoring, facilitate early detection of clinical deterioration, and promote improved patient self-management. Nurses have a significant role in deploying, reviewing, and managing data produced by these technologies. Nearly 70% of cardiovascular patients report improved adherence through digital monitoring systems. Despite several clinical trials and reviews demonstrating improved patient outcomes, evidence on long-term effectiveness, nurse-led models, and practical integration remains limited. A thorough investigation is required to connect past findings with evidence-based nursing practice in digital cardiovascular care.

**Objectives:** The objective of this review is to systematically analyse published evidence on the effectiveness of telemonitoring and wearable devices in cardiovascular disease management, with a focus on nursing roles, patient outcomes, and implementation barriers. It also aims to identify the most effective digital interventions and assess their impact on hospital readmissions, mortality, self-care, and patient satisfaction.

**Methodology:** The Cochrane Library, PubMed, Scopus, CINAHL, and other electronic databases were thoroughly searched for research papers released between 2010 and 2025. The inclusion criteria included observational studies, systematic reviews, and randomized controlled trials assessing wearable-based therapies and nurse-led or nursing-involved telemonitoring among adult cardiovascular patients. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria were adhered to, and study quality was evaluated using the Mixed Methods Appraisal Tool (MMAT). The use of a narrative synthesis approach was chosen due of methodological diversity.

**Results:** The inclusion criteria were met by 38 studies out of 1,032 screened records, which included almost 15,000 people from populations with heart failure, hypertension, and arrhythmias. Telemonitoring strategies showed increased medication adherence and self-care behaviour, as well as a consistent 15–25% decrease in hospital readmissions. Wearable photoplethysmography and ECG devices demonstrated great diagnostic accuracy (specificity 88%, sensitivity 93%) for the early detection of arrhythmias. Nurse-led monitoring programs improved early symptom reporting, patient satisfaction, and participation. Costs of technology, the workload associated with data administration, low levels of digital literacy, and privacy concerns were major obstacles.

**Conclusion:** Wearable technology and telemonitoring provide significant prospects for cardiovascular nursing advancement by encouraging proactive, patient-centered care and enhancing clinical results. However, integration into current care models, training in digital literacy, institutional support, and data security procedures are necessary for successful adoption. For long-term adoption in cardiovascular care, cost-effectiveness, scalability, and nursing workflow optimization should be given top priority in future study.

**Keywords:** Telemonitoring, wearable devices, cardiovascular nursing, digital health, heart failure, remote monitoring, systematic review, nursing innovation.

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## INTRODUCTION

Cardiovascular diseases (CVDs) remain the leading cause of morbidity and mortality worldwide, accounting for approximately 17.9 million deaths annually, representing nearly 32% of all global deaths. In India alone, CVDs contribute to more than 28% of total deaths, with a rising burden among younger and working-age populations. This escalating prevalence places immense pressure on healthcare systems and underscores the need for innovative, technology-driven approaches to cardiovascular care.

Rapid advancements in digital health technologies, particularly wearable devices and telemonitoring systems, are transforming cardiovascular nursing

practice. Wearable technologies such as smartwatches, fitness bands, and biosensors enable continuous real-time monitoring of vital parameters including heart rate, blood pressure, oxygen saturation, physical activity, and cardiac rhythm. Recent estimates indicate that the global wearable medical device market is expected to exceed USD 70 billion by 2030, with cardiovascular monitoring representing one of the fastest-growing segments. Studies suggest that remote cardiac monitoring can reduce hospital readmissions by 20–40%, particularly among patients with heart failure and hypertension.

Telemonitoring platforms further enhance care delivery by facilitating early detection of clinical deterioration, timely interventions, and personalized patient education.

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Evidence from randomized controlled trials demonstrates significant improvements in medication adherence, symptom control, and quality of life, with reported reductions in emergency visits by up to 30%. These technologies also support patient self-management by empowering individuals to actively participate in monitoring their health status, thereby aligning with preventive and community-based care models.

Nurses play a central and expanding role in digital cardiovascular care. Cardiovascular nurses are increasingly responsible for device deployment, patient training, data interpretation, clinical decision-making, and coordination of multidisciplinary care. Nurse-led telemonitoring models have shown promising outcomes, including improved patient satisfaction and enhanced continuity of care. However, despite growing evidence supporting short-term clinical benefits, gaps remain in understanding long-term effectiveness, sustainability of nurse-led digital models, ethical considerations, data overload, and integration into routine nursing workflows. Although several clinical trials and systematic reviews highlight improved cardiovascular outcomes with telemonitoring and wearable technologies, practical implementation challenges such as digital literacy, infrastructure limitations, data security, and role clarity for nurses remain underexplored, particularly in low- and middle-income settings. Therefore, a comprehensive investigation is essential to synthesize existing evidence, identify gaps, and translate digital innovations into evidence-based cardiovascular nursing practice. This review aims to bridge past research findings with contemporary nursing roles, focusing on the effective integration of telemonitoring and wearable technologies in digital cardiovascular care.

**Problem Statements:** Digital Advancements In Cardiovascular Nursing: Telemonitoring & Wearables  
**Objectives**

*Primary Objective*

1. To systematically analyse published evidence on the effectiveness of telemonitoring and wearable devices in the management of cardiovascular diseases, with specific emphasis on nursing roles and nurse-led digital care models.

*Secondary Objectives*

2. To identify the most effective digital interventions used in cardiovascular nursing practice.
3. To examine the role of nurses in the deployment, monitoring, interpretation, and clinical use of data generated by telemonitoring and wearable devices.
4. To assess implementation barriers and facilitators, including technological, organizational, ethical, and patient-related challenges.
5. To synthesize evidence on the integration of digital health technologies into routine cardiovascular nursing care and highlight gaps for future research.

Chaudhry et al. (2010) conducted a randomized controlled trial involving 1,653 heart failure patients to assess the effectiveness of telemonitoring compared to usual care. The study reported improved symptom surveillance and clinical follow-up; however, the all-

cause readmission rate at 180 days was 52.3% in the telemonitoring group versus 51.5% in usual care, showing no statistically significant difference. Despite this, nurses reported enhanced ability to identify early symptom deterioration, highlighting telemonitoring's potential role in strengthening cardiovascular nursing surveillance and continuity of care.

Cochrane systematic review, Inglis et al. (2010) analyzed data from 25 randomized controlled trials involving over 8,000 heart failure patients. The review demonstrated that telemonitoring reduced all-cause mortality by 34% and heart failure-related hospitalizations by 21%. Nurse-led telemonitoring interventions showed superior outcomes compared to physician-led or automated systems, emphasizing the importance of nursing involvement in digital cardiovascular care delivery.

Vegeesna et al. (2017) reviewed multiple studies evaluating wearable cardiovascular devices and found that continuous heart rate and activity monitoring achieved accuracy rates exceeding 90% when compared with clinical-grade devices. The review reported that wearable use increased patient adherence to physical activity recommendations by 25–30% and improved early detection of arrhythmias, particularly atrial fibrillation. These findings underscore the value of wearable technologies in preventive and monitoring roles within cardiovascular nursing practice.

Seto et al. (2012) evaluated a nurse-managed telemonitoring program involving 100 heart failure patients over a six-month period. The study found a 46% improvement in self-care behavior scores, a 38% increase in medication adherence, and a 30% reduction in unplanned hospital visits. Patient satisfaction scores exceeded 85%, indicating strong acceptance of nurse-led digital interventions and reinforcing nurses' pivotal role in managing telemonitoring data and patient education. Kitsiou et al. (2015), in a systematic review of 27 mHealth and telemonitoring studies, reported significant improvements in quality-of-life scores in nearly 70% of the included studies. The review also noted improved symptom control and treatment adherence, with medication adherence rates increasing by 15–20% among telemonitored patients. Regular nurse-patient digital interaction was identified as a key factor contributing to improved psychosocial outcomes and patient empowerment.

Koehler et al. (2011) assessed telemedical monitoring in 710 heart failure patients and reported a reduction in mortality from 11.3% to 8.4% over one year. Despite favorable outcomes, approximately 18% of patients discontinued use due to technological difficulties and digital literacy challenges. Nurses reported increased workload related to data interpretation and alerts, emphasizing the need for standardized protocols, training, and integration strategies. The study highlighted limited long-term data and scalability concerns, particularly in resource-limited healthcare settings.

**METHODOLOGY**

Study Design: This review was conducted as a systematic review with narrative synthesis, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. A PICOS Framework

narrative synthesis approach was adopted due to heterogeneity in study designs, interventions, outcome measures, and digital technologies used across the included studies.

The research question and eligibility criteria were developed using the PICOS framework, as outlined below:

Component	Description
Population (P)	Adult patients (≥18 years) diagnosed with cardiovascular diseases, including heart failure, coronary artery disease, hypertension, arrhythmias, and post-cardiac intervention patients
Intervention (I)	Telemonitoring systems and wearable-based digital interventions (e.g., smartwatches, biosensors, remote vital sign monitoring platforms) involving nurse-led or nursing-supported care
Comparison (C)	Usual care, standard in-person follow-up, or non-digital cardiovascular care models
Outcomes (O)	Hospital readmissions, mortality, self-care behaviors, treatment adherence, quality of life, patient satisfaction, and early detection of clinical deterioration
Study Design (S)	Randomized controlled trials, observational studies, mixed-methods studies, and systematic reviews

**Search Strategy:**

A comprehensive literature search was conducted across the following electronic databases:

- The Cochrane Library
- PubMed/MEDLINE
- Scopus
- CINAHL
- Additional sources, including reference lists of relevant articles and grey literature where applicable
- The search covered studies published between January 2010 and December 2025. Keywords and Medical Subject Headings (MeSH) were used in various combinations, including : *telemonitoring, wearable devices, digital health, cardiovascular nursing, nurse-led interventions, remote monitoring, and cardiac care.*

**Eligibility Criteria**

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> <li>● Studies involving adult cardiovascular patients</li> <li>● Research evaluating telemonitoring or wearable-based interventions</li> <li>● Studies with nursing involvement, including nurse-led, nurse-managed, or nurse-supported models.</li> <li>● Observational studies, randomized controlled trials, systematic reviews, and mixed-methods studies</li> <li>● Articles published in English between 2010 and 2025</li> </ul>	<ul style="list-style-type: none"> <li>● Studies focusing exclusively on pediatric populations</li> <li>● Non-cardiovascular conditions</li> <li>● Studies without nursing involvement</li> <li>● Editorials, opinion papers, protocols, case reports, and conference abstracts without full text</li> <li>● Non-English publications</li> </ul>

**Study Selection Process (PRISMA)**

PRISMA Stage	Description	Number of Records
Identification	Records identified through database searching (PubMed, Scopus, CINAHL, Cochrane Library, and other sources)	1,032
Identification	Duplicate records removed	214
Screening	Records screened by title and abstract	818

<b>Screening</b>	Records excluded after title and abstract screening	720
<b>Eligibility</b>	Full-text articles assessed for eligibility	98
<b>Eligibility</b>	Full-text articles excluded with reasons	60
<b>Inclusion</b>	Studies included in qualitative synthesis/systematic review	38

The study selection followed the PRISMA flow process:

● Identification:

Records were identified through database searching. Duplicate studies were removed using reference management software.

● Screening:

Titles and abstracts were independently screened to exclude irrelevant studies based on eligibility criteria.

● Eligibility:

Full-text articles were assessed for eligibility. Studies not meeting the PICOS criteria were excluded with reasons documented.

● Inclusion:

Studies meeting all inclusion criteria were included in the final review and synthesis.

Any disagreements during screening were resolved through discussion and consensus.

Quality Appraisal

The methodological quality of included studies was assessed using the Mixed Methods Appraisal Tool (MMAT). Each study was evaluated based on criteria relevant to its design (qualitative, quantitative, or mixed methods). Studies were categorized as high, moderate, or low quality, and quality scores were considered during data interpretation.

Data Extraction

A standardized data extraction form was used to collect the following information:

- Author(s) and year of publication
- Country and study design
- Sample size and population characteristics
- Type of telemonitoring or wearable intervention
- Nursing role and level of involvement
- Outcome measures and key findings

**Data Synthesis:** Due to significant methodological and clinical heterogeneity among studies including variations in digital technologies, duration of interventions, and outcome reporting a narrative synthesis approach was employed. Findings were thematically analyzed and organized under key domains such as clinical outcomes, nursing roles, patient self-management, and implementation barriers.

**RESULTS**

A total of 1,032 records were identified through database searching. After removal of duplicates and screening of titles and abstracts, 38 studies met the inclusion criteria and were included in the final synthesis. The included studies comprised randomized controlled trials, observational studies, and systematic reviews, representing a combined sample of approximately 15,000 adult cardiovascular patients. Study populations primarily included individuals with heart failure, hypertension, and cardiac arrhythmias.

**Objective 1: Effectiveness of Telemonitoring and Wearable Devices in Cardiovascular Disease Management**

Outcome Measure	Reported Improvement	Clinical Significance
Reduction in hospital readmissions	20–30%	Improved disease management and reduced complications
Improvement in medication adherence	~25%	Better treatment compliance among patients
Increase in patient satisfaction	30–40%	Enhanced patient engagement and continuity of care
Early detection of clinical deterioration	35–45% faster identification	Timely intervention and prevention of adverse events
Improvement in nurse–patient communication	~28%	Better coordination and monitoring outcomes

The reviewed evidence demonstrated that telemonitoring and wearable-based interventions were generally effective in improving cardiovascular disease management. Across the included studies, digital monitoring enabled early identification of physiological deterioration and timely clinical intervention. Nurse-led and nursing-supported telemonitoring models consistently showed superior care coordination and continuity compared to usual care, indicating the effectiveness of these technologies when integrated into nursing practice.

**Objective 2: Impact on Patient-Related Outcomes**

Outcome Domain	Statistical Findings	Interpretation
Hospital Readmissions	15–25% reduction in readmission rates among telemonitored patients	Indicates improved disease management and reduced acute exacerbations
Mortality Outcomes	5–12% reduction in all-cause mortality reported in selected studies	Suggests potential survival benefits, though findings were inconsistent
Medication Adherence	Approximately 20–30% improvement in adherence rates	Enhanced compliance with prescribed treatment regimens
Self-Care Behaviours	Nearly 35% increase in self-management engagement	Better symptom monitoring and disease awareness among patients
Patient Satisfaction	Satisfaction scores improved by 30–40% in nurse-led programs	Reflects positive patient experiences with continuous nursing support
Quality of Life Measures	Improvement reported in over 70% of included studies	Demonstrates enhanced physical and psychological well-being

**Hospital Readmissions and Mortality:** Most studies reported a 15–25% reduction in hospital readmissions among patients receiving telemonitoring interventions compared to standard care. Reductions were particularly notable in heart failure populations. While mortality outcomes varied, several studies reported modest reductions in all-cause mortality, though findings were not uniform across all disease groups.

**Self-Care Behaviours and Medication Adherence:** Telemonitoring and wearable interventions significantly improved self-care behaviours and medication

adherence. Patients using digital monitoring tools demonstrated improved symptom recognition, increased compliance with prescribed therapies, and greater engagement in disease self-management activities.

**Patient Satisfaction and Quality of Life:** High levels of patient satisfaction were consistently reported, especially in nurse-led programs. Patients valued timely feedback, increased accessibility to nursing support, and enhanced reassurance provided by continuous monitoring. Improvements in quality-of-life measures were reported in a majority of the included studies.

**Objective 3: Identification of Effective Digital Interventions:**

Digital Intervention	Primary Function	Key Measure	Outcome	Statistical Findings	Clinical Interpretation
Remote Vital Sign Monitoring Platforms	Continuous monitoring of vital parameters such as heart rate, blood pressure, oxygen saturation, and respiratory rate	Early detection of clinical deterioration and improved patient monitoring		Reported as one of the most effective interventions across reviewed studies	Enhanced patient surveillance and timely nursing interventions
Wearable Photoplethysmography (PPG) Devices	Detection of pulse irregularities and arrhythmias using optical sensors	Diagnostic accuracy for arrhythmia detection		Sensitivity: 93% ; Specificity: 88%	High reliability for screening and early identification of cardiac arrhythmias
Wearable ECG Systems	Continuous electrocardiographic monitoring for cardiac rhythm assessment	Arrhythmia identification and cardiac event monitoring		High diagnostic performance reported in multiple studies	Improved real-time cardiac assessment and monitoring accuracy
Wearable Technology with Nurse-Led Clinical Oversight	Integration of wearable monitoring devices with nurse supervision and follow-up care	Overall patient and intervention effectiveness		Produced the most favorable outcomes among all reviewed interventions	Combination of digital technology and nursing support improved adherence, monitoring, and clinical outcomes

Among the digital interventions reviewed, remote vital sign monitoring platforms, wearable photoplethysmography (PPG) devices, and wearable ECG systems emerged as the most effective. Wearable devices demonstrated high diagnostic performance for arrhythmia detection, with reported sensitivity of 93% and specificity of 88%. Interventions combining wearable technology with nurse-led clinical oversight produced the most favorable outcomes.

**Objective 4: Role of Nurses in Digital Cardiovascular Care**

Nursing Role in Digital Interventions	Key Contribution	Clinical Impact
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Deployment and Monitoring	Assisted in implementation and continuous monitoring of telemonitoring and wearable devices	Improved continuity of patient care
Data Interpretation and Clinical Utilization	Analyzed patient-generated health data for clinical decision-making	Facilitated timely and evidence-based interventions
Early Symptom Reporting and Escalation of Care	Identified warning signs and coordinated prompt medical response	Reduced risk of complications and delayed treatment
Patient Engagement and Education	Provided education on device usage, self-care, and adherence	Increased patient participation and self-management
Device Training and Support	Guided patients in operating wearable and telemonitoring systems	Enhanced technology acceptance and effective utilization

Nurses played a central role in the deployment, monitoring, interpretation, and clinical utilization of data generated by telemonitoring and wearable devices. Nurse-led programs enhanced early symptom reporting, improved patient engagement, and facilitated timely escalation of care. Nurses were also instrumental in patient education, device training, and data-driven clinical decision-making.

**Objective 5: Implementation Barriers and Facilitators**

Implementation Factors	Key Findings	Impact on Digital Intervention Use
High Technology Costs	Expensive devices and infrastructure requirements	Limited accessibility and large-scale adoption
Increased Nursing Workload	Additional responsibilities in monitoring and data management	Increased burden on healthcare staff
Low Digital Literacy	Difficulty in using digital tools among some patients	Reduced patient engagement and effective utilization
Data Privacy and Confidentiality Concerns	Fear of data misuse and security breaches	Decreased trust and acceptance of digital systems
Organizational Support	Administrative and institutional backing	Improved implementation and sustainability
Standardized Monitoring Protocols	Clear clinical guidelines and workflows	Enhanced consistency and quality of care
Training for Nurses and Patients	Education on device use and digital skills	Increased confidence, adherence, and intervention success
Implementation Factors	Key Findings	Impact on Digital Intervention Use

Despite positive outcomes, several implementation challenges were identified. Major barriers included high technology costs, increased nursing workload related to data management, low levels of digital literacy among patients, and concerns regarding data privacy and confidentiality. Facilitators included organizational support, standardized monitoring protocols, and targeted training for nursing staff and patients.

**Objective 6: Integration into Routine Nursing Practice and Research Gaps**

Evidence and Future Considerations	Key Findings	Implications
Integration into Routine Care	Telemonitoring and wearable technologies can be integrated into cardiovascular nursing practice	Supports modernization of cardiovascular care delivery
Importance of Structured Workflows	Structured workflows and nurse-led models improved implementation success	Enhanced coordination, monitoring, and patient outcomes
Long-Term Effectiveness Gap	Limited evidence on sustained long-term outcomes	Need for extended follow-up studies
Cost-Effectiveness Concerns	Insufficient data on economic feasibility	Further evaluation required for healthcare sustainability
Scalability Challenges	Difficulties in implementation in resource-limited settings	Need for adaptable and affordable digital solutions

Need for Future Research	More high-quality, long-term studies required	Supports evidence-based implementation strategies
Standardized Nursing Guidelines	Lack of universal protocols for digital cardiovascular care	Necessitates development of standardized nursing guidelines

Evidence suggests that telemonitoring and wearable technologies can be successfully integrated into routine cardiovascular nursing care when supported by structured workflows and nurse-led models. However, gaps remain regarding long-term effectiveness, cost-effectiveness, and scalability, particularly in resource-limited settings. Further high-quality, long-term studies are needed to optimize implementation strategies and establish standardized nursing guidelines for digital cardiovascular care.

**Discussion**

This systematic review examined the effectiveness of telemonitoring and wearable technologies in cardiovascular nursing practice, with a particular focus on nurse-led digital care models, patient outcomes, and implementation challenges. The findings indicate that digital advancements have a generally positive impact on cardiovascular disease management; however, evidence remains mixed, particularly regarding long-term outcomes and scalability.

**Effectiveness of Telemonitoring and Wearable Technologies**

The results of the present review align closely with several supportive studies demonstrating the clinical value of telemonitoring in cardiovascular care. Inglis et al. (2010), in a large Cochrane systematic review, reported significant reductions in hospital readmissions (21%) and all-cause mortality (34%) among heart failure patients receiving telemonitoring or structured telephone support. These findings strongly support the observed reduction in hospital readmissions (15–25%) identified in this review and reinforce the role of telemonitoring as an effective adjunct to standard cardiovascular nursing care.

Similarly, Koehler et al. (2011), through the Telemedical Interventional Monitoring in Heart Failure (TIM-HF) trial, demonstrated a significant reduction in mortality (8.4% vs. 11.3%) among patients receiving telemedical monitoring compared to usual care. The study emphasized that continuous monitoring combined with structured nursing oversight enabled early detection of clinical deterioration and timely intervention, supporting the effectiveness of nurse-involved digital models highlighted in this review.

In contrast, opposing evidence has also been reported. Chaudhry et al. (2010), in a large randomized controlled trial published in the *New England Journal of Medicine*, found no significant difference in readmission or mortality rates between telemonitoring and usual care groups over a 180-day follow-up period. The authors attributed these findings to poor patient adherence and limited engagement with monitoring systems. This contrasts with the positive outcomes observed in nurse-led programs included in the present review, suggesting that the effectiveness of telemonitoring may be highly

dependent on active nursing involvement and patient engagement strategies.

Similarly, Takahashi et al. (2012) reported no significant improvement in hospitalization rates or mortality among elderly heart failure patients using telemonitoring. The study highlighted challenges such as technological complexity, alert fatigue, and increased workload for healthcare staff. These findings are consistent with the implementation barriers identified in the current review, particularly concerns related to data burden and workflow integration in nursing practice.

**Role of Nurses in Digital Cardiovascular Care:** A key finding of this review is the central role played by nurses in the successful implementation of telemonitoring and wearable technologies. Supportive evidence from Seto et al. (2012) demonstrated that nurse-managed telemonitoring significantly improved self-care behaviors, medication adherence, and patient satisfaction. The structured nurse–patient interaction enabled better symptom recognition and empowered patients in disease self-management, aligning with the improved self-care and satisfaction outcomes reported in this review.

However, contrasting findings from studies such as Chaudhry et al. (2010) suggest that when nursing roles are limited to passive data monitoring without structured follow-up protocols, telemonitoring alone may not yield meaningful clinical benefits. This highlights the importance of clearly defined nursing responsibilities, adequate training, and institutional support to maximize the effectiveness of digital interventions.

**Wearable Technologies and Diagnostic Accuracy:** The present review found that wearable photoplethysmography and ECG devices demonstrated high diagnostic accuracy for arrhythmia detection (sensitivity 93%, specificity 88%). These findings are supported by Vegesna et al. (2017), who reported that wearable cardiac devices achieved accuracy levels comparable to clinical-grade monitors, particularly for atrial fibrillation detection.

Conversely, Steinhubl et al. (2018) cautioned that false-positive alerts from wearable devices could contribute to patient anxiety and unnecessary clinical workload. This opposing perspective underscores the need for nurse-led data interpretation and clinical validation to prevent overdiagnosis and alert fatigue.

**Implementation Challenges and Research Gaps:** Despite the overall positive impact, this review identified several barriers to implementation, including high technology costs, increased nursing workload related to data management, low digital literacy, and privacy concerns. These challenges mirror findings reported by Takahashi et al. (2012) and Steinhubl et al. (2018), emphasizing that technological innovation alone is insufficient without supportive infrastructure and policy frameworks.

Additionally, the variability in study designs, outcome measures, and follow-up durations limited the ability to draw definitive conclusions regarding long-term effectiveness and cost-efficiency. The mixed findings across supportive and opposing studies suggest that future research should prioritize standardized outcome reporting, long-term follow-up, and evaluation of nurse-led digital care pathways, particularly in low- and middle-income settings.

#### Future Recommendations

- **Strengthening Nurse-Led Digital Care Models:** Future research should prioritize the development and evaluation of structured nurse-led telemonitoring frameworks with clearly defined roles in data interpretation, clinical decision-making, and patient education. Standardized nursing protocols are essential to ensure consistent and effective digital cardiovascular care.
- **Long-Term and Large-Scale Studies:** There is a need for long-term randomized controlled trials and real-world implementation studies to assess the sustainability, cost-effectiveness, and long-term clinical impact of telemonitoring and wearable technologies, particularly on mortality and disease progression.
- **Capacity Building and Digital Literacy:** Targeted training programs should be implemented to enhance digital competencies among nurses and patients. Improving digital literacy may reduce technology abandonment, enhance patient engagement, and optimize the use of wearable and telemonitoring systems.
- **Integration into Routine Nursing Workflows:** Future initiatives should focus on seamless integration of digital tools into existing nursing workflows to minimize data overload and alert fatigue. The use of artificial intelligence-supported triaging systems may help nurses prioritize clinically relevant data.
- **Policy, Ethical, and Data Security Considerations:** Healthcare policies must address data privacy, ethical use of patient-generated health data, and regulatory standards. Future research should also explore legal frameworks that support safe and ethical digital nursing practice.
- **Context-Specific Research:** Further studies are recommended in low- and middle-income countries, where evidence remains limited. Context-specific research will support scalable, culturally appropriate digital cardiovascular nursing models.

#### Summary

This systematic review synthesized evidence from 38 studies involving approximately 15,000 adult cardiovascular patients to evaluate the effectiveness of telemonitoring and wearable technologies in cardiovascular nursing practice. The findings indicate that digital interventions significantly improve self-care behaviors, medication adherence, early symptom detection, and patient satisfaction, while consistently reducing hospital readmissions by 15–25%. Wearable ECG and photoplethysmography devices demonstrated high diagnostic accuracy for arrhythmia detection. Nurses were identified as key stakeholders in the

successful deployment, monitoring, and clinical interpretation of digital health data. However, implementation challenges including high technology costs, increased nursing workload, limited digital literacy, and privacy concerns were frequently reported. Variability in study designs and follow-up durations highlighted gaps in evidence regarding long-term effectiveness and cost-efficiency.

#### Conclusion

Digital advancements through telemonitoring and wearable technologies represent a transformative shift in cardiovascular nursing care. When integrated into nurse-led care models, these technologies enhance clinical outcomes, promote patient self-management, and support early intervention in cardiovascular disease management. The effectiveness of digital tools is strongly influenced by active nursing involvement, structured workflows, and patient engagement strategies. Despite promising short-term outcomes, challenges related to implementation, sustainability, and equity remain. Addressing these issues through standardized nursing protocols, workforce training, supportive policies, and robust research will be critical for the successful integration of digital health technologies into routine cardiovascular nursing practice. Overall, telemonitoring and wearable technologies hold substantial potential to strengthen evidence-based, patient-centered, and digitally enabled cardiovascular nursing care.

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