

Artificial intelligence in cardiac nursing practice: A systematic review of applications, challenges, and patient outcomes

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ABSTRACT

Cardiovascular diseases remain the leading cause of global mortality, requiring innovative approaches to improve cardiac care. This systematic review aimed to examine the applications of Artificial Intelligence (AI) in cardiac nursing practice, identify implementation challenges, and assess its impact on patient outcomes. The review was conducted in accordance with PRISMA 2020 guidelines, using PubMed, ScienceDirect, CINAHL, and Web of Science. Original studies published between 2020 and 2025 that explicitly addressed nursing roles in cardiac care were included. Eleven studies met the inclusion criteria and were appraised using the Joanna Briggs Institute (JBI) tools. The results show that AI applications, including ChatGPT and machine learning models, support cardiac nursing through clinical decision support, patient education, risk prediction, and home-based monitoring. These applications were associated with improved nursing efficiency, enhanced patient self-management, early detection of clinical deterioration, and potential reduction in hospitalization. However, challenges such as data accuracy, ethical concerns, algorithm transparency, and limited digital literacy among nurses were consistently reported. In conclusion, AI has strong potential to enhance evidence-based and patient-centered cardiac nursing practice. Successful integration requires ethical governance, adequate training, and interdisciplinary collaboration to ensure safe and effective implementation.

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INTRODUCTION

Cardiovascular diseases (CVDs) continue to represent the leading cause of morbidity and mortality globally, accounting for approximately 17.9 million deaths each year (Di Cesare et al., 2024). The burden of heart failure, myocardial infarction, and arrhythmias continues to rise due to population

aging, lifestyle factors, and limited accessibility to continuous care (Jenča et al., 2021). Cardiac nursing practice plays a pivotal role in monitoring patients, managing complex treatment regimens, and providing education to support adherence and lifestyle modification (Al-Dhafeeri et al., 2024). However, the increasing volume of clinical data and the complexity of decision-making in cardiac care present major challenges for nurses, highlighting the need for advanced technological support to enhance patient care efficiency and safety.

Artificial Intelligence (AI) has emerged as a promising technology that can revolutionize healthcare delivery through predictive analytics, automated decision support, and data-driven clinical insights (Bajwa et al., 2021). In cardiac care, AI has been applied in diverse domains such as arrhythmia detection using electrocardiograms (ECGs), prediction of heart failure readmission, optimization of medication management, and patient monitoring through wearable sensors (Armoundas et al., 2017). For nursing practice, AI tools have the potential to augment clinical judgment, facilitate early detection of patient deterioration, and improve individualized care planning (Wei et al., 2025). These innovations can support nurses in managing large datasets, reducing errors, and enhancing the quality of cardiac care.

Despite these advances, several challenges hinder the full integration of AI into cardiac nursing practice. Ethical concerns regarding data privacy, algorithmic transparency, and accountability persist (Ball Dunlap & Michalowski, 2024). Additionally, practical barriers such as limited digital literacy among nurses, insufficient institutional support, and lack of clear regulatory guidance impede the adoption of AI technologies in clinical settings (Ramadan et al., 2024). While previous reviews have explored AI applications in cardiology, most have focused on physician-centered or technical perspectives, with limited attention to the nursing context and patient-centered outcomes (Gala et al., 2024). Therefore, a comprehensive synthesis of evidence is needed to understand how AI has been implemented in cardiac nursing, its impact on patient outcomes, and the challenges encountered in practice (Gala et al., 2024).

The academic and practical urgency of examining Artificial Intelligence (AI) in cardiac nursing practice has become increasingly prominent in the current healthcare context. Since 2020, rapid advancements in AI and digital health technologies have expanded their use in clinical decision support, patient education, and remote monitoring; however, evidence focusing on nursing roles and patient-centered outcomes in cardiac care remains limited. Practically, the rising burden of cardiovascular diseases, increasing patient complexity, and nursing workforce constraints underscore the need for innovative tools that enhance efficiency, early risk detection, and quality of care.

The present study aims to conduct a systematic review of the literature on Artificial Intelligence in Cardiac Nursing Practice, focusing on three primary aspects: 1 applications of AI in cardiac nursing, 2 challenges and barriers to its implementation, and 3 effects on patient outcomes. The overarching research question guiding this review is: *How has Artificial Intelligence been applied in cardiac nursing practice, what challenges are encountered, and how do these applications influence patient outcomes?*

RESEARCH METHOD

This study uses a systematic review design with a narrative-descriptive approach to examine the application and development of Artificial Intelligence (AI) in the field of nursing/healthcare. This approach was chosen to provide a comprehensive overview of the concepts, types of technology, benefits, and challenges of AI application based on the latest scientific evidence.

Defining and Aligning Goals and Questions

This systematic review was guided by clearly defined and aligned goals and research questions to ensure methodological rigor and coherence. The primary goal was to synthesize evidence on the implementation of Artificial Intelligence (AI) in cardiac nursing practice,

addressing gaps in the literature that predominantly focus on physician-centered or technical applications. Accordingly, the research questions were structured to examine three key domains: the types of AI applications used in cardiac nursing, the challenges and barriers to their implementation, and the impact of AI-supported nursing practices on patient outcomes. This alignment informed the development of eligibility criteria, search strategy, data extraction, and narrative synthesis, ensuring that all included studies explicitly reflected nursing roles and patient-centered outcomes within cardiac care.

Develop and Align Inclusion Criteria with Objectives and Questions

The inclusion criteria for this systematic review were carefully developed and aligned with the study objectives and research questions to ensure relevance, consistency, and methodological rigor. Studies were included if they involved Artificial Intelligence (AI) applications within cardiac nursing practice, explicitly addressed nursing roles, and reported outcomes related to patient care or implementation challenges. To capture recent and clinically relevant evidence, only original research articles published in English between 2020 and 2025 were considered. Exclusion criteria were applied to studies focusing solely on physician practice, technical algorithm development without nursing involvement, reviews, editorials, or studies lacking patient-related outcomes. This alignment ensured that the selected evidence directly supported the review's aim of evaluating AI applications, challenges, and patient outcomes in cardiac nursing practice.

Table 1. PICOS framework

PICOS Element	Description
Population (P)	Patients with cardiovascular or cardiac-related conditions and nurses involved in cardiac nursing practice (e.g., acute care, critical care, home care, rehabilitation)
Intervention (I)	Artificial Intelligence applications in cardiac nursing practice (e.g., ChatGPT, machine learning models, clinical decision support systems, predictive analytics)
Comparison (C)	Usual nursing care without AI support or comparison between different AI models/versions (if applicable)
Outcomes (O)	Patient outcomes (e.g., early detection of deterioration, reduced hospitalization, improved self-management), nursing outcomes (e.g., decision-making accuracy, efficiency), and implementation challenges
Study Design (S)	Original empirical studies, including descriptive qualitative studies, cross-sectional studies, and observational designs

Identifying Relevant Studies

Relevant studies were identified through a comprehensive and systematic literature search conducted in four electronic databases: PubMed, ScienceDirect, CINAHL, and Web of Science. The search strategy was developed to align with the review objectives and research questions, using controlled keywords and Boolean operators to capture studies addressing Artificial Intelligence in cardiac nursing practice and patient outcomes. Searches were limited to peer-reviewed articles published in English between 2020 and 2025. Reference lists of included studies were also screened to identify additional relevant articles and minimize the risk of missing eligible evidence. Boolean search strategy: (*"artificial intelligence" OR "machine learning" OR "deep learning" OR "ChatGPT"*) AND (*"cardiac nursing" OR "cardiology nursing" OR "cardiac care"*) AND (*"patient outcomes" OR "clinical practice" OR "nursing practice" OR "implementation"*)

Study Selection

The study selection process was conducted systematically in accordance with the review objectives and predefined eligibility criteria. All records retrieved from the database searches were screened in three stages: removal of duplicates, title and abstract screening, and full-text assessment. Two independent reviewers evaluated study eligibility, focusing on relevance to Artificial Intelligence applications in cardiac nursing practice, nursing roles, and reported patient-related outcomes or implementation challenges. Any disagreements during the selection process were resolved through discussion to ensure consistency and transparency in study inclusion.

Table 2. Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Population	Studies involving cardiac patients and/or nurses in cardiac nursing practice	Studies focusing exclusively on physicians, technicians, or non-cardiac populations
Concept	Use of Artificial Intelligence in cardiac nursing practice (e.g., ChatGPT, machine learning, decision support systems)	AI studies limited to technical algorithm development without clinical or nursing application
Context	Clinical, community, home care, or educational settings related to cardiac nursing	Non-healthcare settings or cardiology studies without nursing involvement
Outcomes	Patient outcomes, nursing practice outcomes, or implementation challenges	Studies not reporting outcomes or practical implications
Study Type	Original empirical research (qualitative, quantitative, or mixed methods)	Reviews, editorials, conference abstracts, opinion papers
Language & Year	English, published between 2020-2025	Non-English articles or publications outside the specified period

Diagram Flow

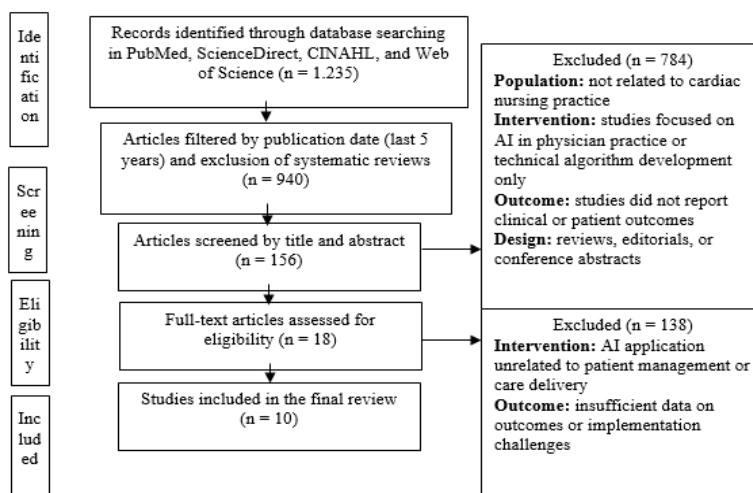


Figure 1. Diagram flow

RESULTS AND DISCUSSIONS

Results

A total of ten studies met the inclusion criteria and were included in the final analysis. The reviewed studies consisted of descriptive and cross-sectional designs, with sample sizes ranging from small clinical simulations to large-scale home health care populations. Overall, the findings indicate that Artificial Intelligence (AI), predominantly ChatGPT-based applications, has been utilized across various domains of cardiac nursing practice, including clinical decision support, patient education, health promotion, and risk prediction. The synthesis of evidence revealed generally positive impacts on nursing roles and patient outcomes, while also identifying recurrent challenges related to accuracy, reliability, and safe implementation of AI in clinical settings.

Table 3. Summary of reviewed studies on artificial intelligence in cardiac nursing practice

No.	Author	Method	Nursing Role	Patient Outcomes	Challenges
1.	(Harskamp & De Clercq, 2024) (Harskamp & De Clercq, 2024)	Method: descriptive design Sample: 20 clinical cases AI Application:	Supporting clinical decision making, initial triage of symptoms, patient education, and interprofessional	ChatGPT demonstrated high accuracy with significant improvement over time, proving effective	ChatGPT may produce biased or inconsistent.

No.	Author	Method	Nursing Role	Patient Outcomes	Challenges
		ChatGPT (OpenAI, version 3.5)	collaboration.	for simple but not complex medical queries.	
2.	(Xu et al., 2024) (Xu et al., 2024)	Method: descriptive design Sample: 10 clinical cases AI Application: ChatGPT 4.0	Focus on health promotion, chronic disease management, and nursing intervention support through the creation of exercise prescriptions.	ChatGPT generates more accurate, comprehensive, and applicable recipes.	ChatGPT may provide risky recommendations if patients have limitations in medication management.
3.	(Rouhi et al., 2024) (Rouhi et al., 2024)	Method: descriptive design Sample: 21 clinical cases AI Application: ChatGPT-3.5	Supports health literacy and patient education.	ChatGPT-3.5 achieved better readability, no factual inaccuracies were detected.	Potential risk of misleading or incomplete content without expert supervision.
4.	(Van Bulck & Moons, 2024) (Van Bulck & Moons, 2024)	Method: cross-sectional Sample: 20 cardiovascular experts AI Application: ChatGPT-3	Assessing reliability, usefulness, and potential risks for patient self-management and health literacy.	ChatGPT responses were generally rated trustworthy, few experts found them dangerous.	Potential inaccuracies and “hallucinations” in AI outputs.
5.	(Yiryuo et al., 2024) (Yiryuo et al., 2024)	Method: cross-sectional Sample: 33 healthcare professionals AI Application: ChatGPT-4	Nurses’ critical judgment in evaluating AI tools for patient and educational use.	Anatomically inaccurate, with incorrect text labels, and largely unsuitable for education.	Poor anatomical precision, and unverified medical data sources.
6.	(Chae et al., 2025) (Chae et al., 2025)	Method: descriptive design Sample: 9.362 home health care patients with heart failure AI Application: ChatGPT-3.5	Supports nurses in home health care by providing CDS alerts for early identification of patients at risk for ED visits or hospitalization.	Strongly predicted adverse outcomes; AI tool can improve timely interventions and reduce rehospitalization risk.	Potential trust barriers among clinicians.
7.	(Hillmann et al., 2024) (Hillmann et al., 2024)	Method: descriptive design Sample: 3 cardiology experts AI Application: ChatGPT Plus GPT-4	Focus on patient education and the reliability of AI-generated cardiac health information for self-learning.	Responses were mostly easy to understand, but medical accuracy and completeness varied.	Subjective assessment, missing relevant medical aspects, and lack of standardization.

No.	Author	Method	Nursing Role	Patient Outcomes	Challenges
8.	(Pham et al., 2024) (Pham et al., 2024)	Method: descriptive design Sample: 20 simulations each for cardiac arrest and bradycardia scenarios AI Application: ChatGPT (GPT-4)	Supports emergency and critical care nursing in applying ACLS protocols and improving decision support during cardiac events.	Potential for aiding adherence to ACLS but inconsistent performance may risk errors.	Repeated errors, incorrect medication doses, lack of image recognition, and limited generalizability beyond two scenarios.
9.	(King et al., 2024) (King et al., 2024)	Method: cross-sectional Sample: 107 heart failure patient AI Application: ChatGPT GPT-3.5 and GPT-4	Supports patient education and self-management in chronic heart failure by improving access to accurate health information.	GPT-4 achieved 100% accuracy and comprehensive answers, both models provided consistent, reliable information useful for patient education.	Possible misinformation.
10.	(Scquizzato et al., 2024) (Scquizzato et al., 2024)	Method: descriptive design Sample: 30 raters AI Application: ChatGPT	Nurses participated as evaluators; focus on accuracy and clarity of AI-generated patient education content related to resuscitation.	ChatGPT provided largely accurate, relevant, and comprehensive information.	Limited accuracy in CPR-specific content and difficult language for laypeople.

Table 4. Mapping

Theme	Focus of AI in Cardiac Nursing
Clinical Decision Support & Risk Prediction	AI to support clinical decision-making, early risk identification, triage, and emergency or home-care interventions (Harskamp & De Clercq, 2024)(Chae et al., 2025)(Pham et al., 2024)
Patient Education & Health Literacy	AI-generated information to support patient education, self-management, and improvement of health literacy in cardiac care(Rouhi et al., 2024)(Hillmann et al., 2024)(King et al., 2024)(Scquizzato et al., 2024)
Health Promotion & Chronic Disease Management	AI-assisted health promotion and lifestyle intervention support for patients with chronic cardiac conditions(Xu et al., 2024)
Evaluation of AI Reliability & Safety	Critical evaluation of accuracy, trustworthiness, and safety of AI tools for nursing and patient use(Van Bulck & Moons, 2024)(Yiryuo et al., 2024)

Discussion

Findings from the reviewed studies indicate that the integration of Artificial Intelligence (AI) in cardiac nursing practice has substantially enhanced clinical efficiency, patient engagement, and decision-making accuracy. AI applications, particularly those using ChatGPT-based and machine learning algorithms, have been utilized across multiple domains, including monitoring, patient education, complication prediction, and clinical decision support. Collectively, these studies highlight AI’s transformative role in supporting nurses’ clinical judgment and optimizing patient outcomes in cardiac care settings.

In the area of patient monitoring, AI systems have demonstrated significant potential to assist nurses in identifying early signs of clinical deterioration. Based on research from (Chae et al., 2025) and (Pham et al., 2024) reported that AI-assisted algorithms analyzing home-care data and cardiac simulations were effective in detecting changes in patient status and predicting risk of emergency visits or readmission. These tools provided automated alerts that improved the timeliness of nursing interventions, thereby reducing preventable complications. Consistent with these findings, the use of AI-supported monitoring aligns with the nursing mandate for continuous

assessment and prevention-oriented care, enhancing both safety and continuity of cardiac patient management (Dailah et al., 2024).

Regarding patient education, studies by (Rouhi et al., 2024), (Hillmann et al., 2024), and (King et al., 2024) demonstrated that ChatGPT and similar chat-based AI systems can generate accurate, readable, and easily understandable educational content for cardiac patients. These technologies support nurses in delivering tailored health education, promoting self-management, and improving adherence to medication and lifestyle modifications. However, researchers also noted the need for expert validation to minimize potential misinformation or incomplete explanations (Oviedo-Trespalacios et al., 2023). This finding reinforces the nurse's role as an educator and information gatekeeper, ensuring that AI-generated materials meet clinical accuracy and ethical standards (Glauberger et al., 2023).

AI also shows considerable promise in predicting complications and adverse cardiac events. Studies utilizing deep learning algorithms have proven effective in forecasting arrhythmias, heart failure exacerbations, and post-surgical complications (Chae et al., 2025). Such predictive insights enable nurses to identify high-risk patients early, personalize follow-up care, and implement preventive strategies before critical deterioration occurs. This predictive function represents a significant shift from reactive to proactive nursing care, emphasizing AI's value in precision nursing and evidence-based clinical decisions (Pan & Zhang, 2024).

The integration of decision support systems (DSS) powered by AI further strengthens the analytical capabilities of nurses. Study from (Harskamp & De Clercq, 2024) and (Van Bulck & Moons, 2024) found that AI-supported DSS enhanced the accuracy of clinical assessments and improved interdisciplinary collaboration. These systems assist nurses in interpreting complex cardiac data, aligning interventions with guideline-based recommendations, and minimizing cognitive workload. Although limitations such as algorithmic transparency, bias, and user trust remain, these studies consistently affirm that AI can augment not replace nursing judgment in cardiac care decision-making.

The findings of this review have important implications for practice, policy, and decision-making in cardiac nursing. Practically, AI-based applications can support nurses in clinical decision-making, early risk detection, patient education, and continuity of care, thereby improving efficiency and patient outcomes while complementing professional nursing judgment. From a policy perspective, the results underscore the need for clear ethical, legal, and regulatory frameworks to ensure safe, accountable, and patient-centered use of AI in nursing practice. For healthcare leaders and decision-makers, this evidence supports strategic investment in AI technologies aligned with nursing workflows and workforce capacity, particularly in response to the growing burden of cardiovascular disease and increasing complexity of care.

Overall, the synthesis of reviewed evidence confirms that AI contributes significantly to cardiac nursing by enhancing monitoring precision, improving patient education, predicting complications, and supporting clinical decisions. The technology's successful implementation, however, depends on adequate training, ethical oversight, and interdisciplinary collaboration to ensure safe, human-centered integration of AI into nursing workflows (Yip et al., 2025).

CONCLUSION

This systematic review concludes that Artificial Intelligence (AI) enhances cardiac nursing practice by improving patient monitoring, education, clinical decision-making, and outcome prediction. AI tools such as ChatGPT and machine learning models support nurses in delivering timely and evidence-based care, although challenges related to data accuracy, ethical issues, and digital literacy persist. Strategically, these findings underscore the need for clear policy frameworks governing AI use in nursing, the integration of AI competencies into professional nursing practice, and further research focused on validating AI systems aligned with nursing workflows and patient-centered outcomes to ensure safe and sustainable implementation.

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