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The Role of Artificial Intelligence in Advancing Clinical Care in Cardiovascular Nursing

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The healthcare landscape is undergoing a significant transformation fueled by artificial intelligence (AI), fundamentally reshaping cardiovascular disease (CVD) care and management. Cardiovascular nurses are uniquely positioned to harness AI-driven innovations to revolutionize the treatment and support of cardiovascular patients. CVD remains a leading global cause of morbidity and mortality, creating substantial economic burden worldwide[1]. As critical stakeholders in CVD prevention, diagnosis, and management, cardiovascular nurses engage with individuals across the lifespan, monitoring patient data, conducting diagnostics, administering treatments, and providing patient education. However, they face numerous challenges, including high patient volumes, increasing care complexity, time constraints, and growing administrative burden—challenges further amplified by critical staffing shortages and escalating chronic disease demands. AI integration presents transformative opportunities to address these challenges.

Artificial intelligence refers to computational systems capable of performing tasks requiring human intelligence such as reasoning, pattern recognition, planning, language comprehension, and problem-solving[2]. Machine learning (ML), a subset of AI, trains algorithms on datasets to create models that can make predictions or decisions without being explicitly programmed. Machine learning essentially gives AI the ability to "learn"[2]. Relevant and detailed data for the question asked, as well as a computational ML technique appropriate for the dataset at hand, must be in place for ML to function[2–3]. Deep learning is a specialized and more advanced form of ML that uses multilayered neural networks that can learn from large datasets but analyze granular factors[3]. Finally, natural language processing (NLP) techniques allow the computer to interpret and understand human language, either spoken or written[4]. In healthcare, AI shows promise in improving diagnostic accuracy, predicting outcomes, optimizing workflows, supporting real-time clinical decisions, enhancing medication management, advancing research, and reducing documentation burden and errors[2,5].

Artificial intelligence tools incorporated into clinical workflows can substantially reduce human error in high-stakes environments like hospitals. By automating routine tasks such as data entry, monitoring vital signs, and providing evidence-based recommendations, AI tools minimize the risk of human oversight or fatigue-related mistakes. Artificial intelligence significantly enhances nursing efficiency by automating repetitive tasks allowing nurses to focus on direct patient care rather than administrative documentation.

Impact on Clinical Care and Nursing Practices

Artificial intelligence is increasingly integrated into healthcare as a support tool for improving clinical decision-making and patient care delivery. Nurses, as frontline caregivers, can leverage AI to make timely, evidence-based decisions, reduce errors, and improve outcomes. Importantly, by automating routine tasks and streamlining complex case management, AI enables nurses to work more efficiently and at the top of their license—allowing more time for direct, high-value patient care. As AI technology continues to evolve, thoughtful integration into nursing practice will undoubtedly lead to better care delivery, improved outcomes, and a safer, more efficient healthcare system. Figure displays the range of functions that AI can offer to support cardiovascular nursing.

In this section, we have outlined the 4 major areas where cardiovascular nurses can engage with AI: documentation, patient monitoring, risk stratification, clinical decision support, and patient education. We also provide use-cases for AI-enabled cardiovascular nursing care in Table.

What's New and Important

- This paper outlines the potential impact of AI across critical areas in clinical cardiovascular nursing, providing examples of clinical application.
- We outline current barriers to AI adoption that require interdisciplinary efforts to promote implementation in the clinical setting.
- A call to action urges nurses to spearhead the integration of AI by leveraging their indispensable clinical expertise and patient advocacy to guide the development, implementation, and ethical oversight of AI systems.

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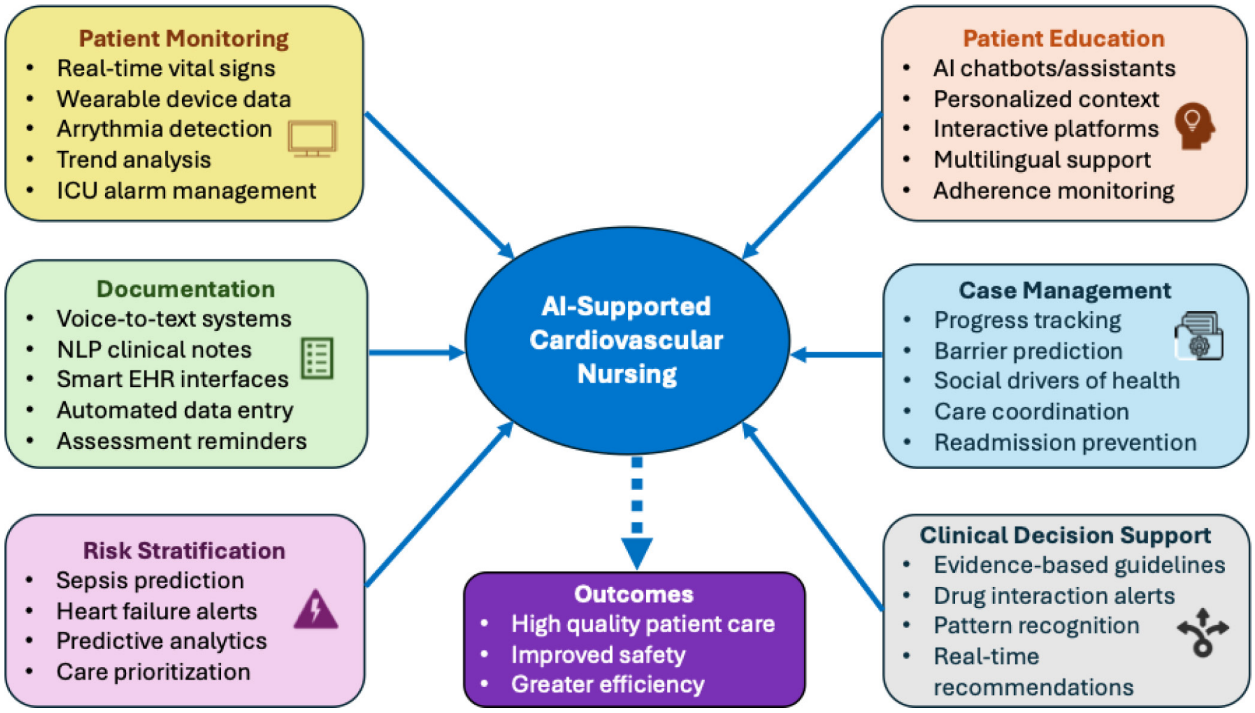

Figure. AI functions to enhance cardiovascular nursing practice. Abbreviations: AI, artificial intelligence; EHR, electronic health record; ICU, intensive care unit; NLP, natural language processing.

Artificial Intelligence for Documentation

Data entry, a crucial but time-consuming task for nurses, can be streamlined with AI-powered voice recognition systems and smart electronic records interfaces. Artificial intelligence tools can automatically input patient data, update charts, and even provide reminders for necessary assessments. This reduces the risk of documentation errors, increases the accuracy of patient records, and allows nurses to focus on higher level clinical care.

One example of this in practice is the use of NLP to transcribe and analyze clinical notes. An investigative group found that NLP systems could automatically transcribe physician and nurse notes in a manner that was as accurate as manual entry, saving substantial time and reducing errors in data entry[11]. As a result, AI-supported documentation including voice-to-text tools allows nurses to spend less time on administrative tasks and more time engaging with patients.

Artificial Intelligence for Patient Monitoring

Artificial intelligence has also been integrated into patient monitoring systems. Artificial intelligence algorithms can analyze continuous data streams from wearable devices or bedside

Table.

Examples of Clinical Applications of AI Tools in Cardiovascular Care.

AI Tool	Clinical Context	Benefit	Outcomes
Remote monitoring[6]	Wearable or implantable devices	Detects rhythm abnormalities, vital sign changes in real-time	Auto alerts the clinical team, anticipating changes in patient status
Acute care monitoring[7]	Ventilated patients	Alarm reduction	Reduced false alarms, improved response times and accurate notifications
ECG[8,9]	Algorithms applied to standard 12 lead ECGs	Detects condition probability, enabling early detection and treatment consideration	Identifies probability of low EF, HCM, AF/silent AF, Ao stenosis, Amyloid, ECG age, diastolic function grade
Algorithms for clinical condition prediction[10]	Clinician approved data point considerations for condition management	Incidental coronary calcium, Nursing LLM virtual assistant, perioperative medication management	Enhanced point of care resource for clinical decision-making, anticipating additional data for complex condition management
Ambient listening tools	To coordinate data collection, clinical notes, and nursing patient assessments	Pull patient provided information directly to clinical charting system in the EHR via ambient listening technologies Pull provider integration into clinical notes	Enhanced nurse/provider time with patient at the point of care appointment Flow sheet documentation via ambient listening
Discharge summaries	To collate hospital courses and pertinent testing and follow-up to generate a discharge summary	Collate clinical course and test results daily throughout a hospitalization to create a succinct log of events to draft a discharge summary for nurses' review and validation	Improved provider burden, enhanced quality of discharge summary. Equipped to expedite patient discharge and enhance care transition.

Abbreviations: AI, artificial intelligence; AF, atrial fibrillation; Ao, aortic; ECG, electrocardiogram; EF, ejection fraction; EHR, electronic health record; HCM, hypertrophic cardiomyopathy; LLM, large language model.

monitors to detect trends and deviations from normal ranges, such as abnormal heart rhythms or vital signs, in real-time. In cases where nurses may not personally observe these changes, the AI system can alert the nurse immediately, helping to promote early intervention and avoid complications. This type of real-time decision support has been particularly beneficial in intensive care units (ICUs) where patients are at increased risk for acute changes in clinical condition. Artificial intelligence tools used for monitoring ventilated patients in the ICU significantly reduced the number of missed alarms and false positives, leading to improved nurse response times and better patient outcomes[12]. This demonstrates the potential of AI to enhance safety by providing support in clinical decision-making.

Artificial Intelligence for Risk Stratification

Artificial intelligence-powered risk stratification transforms cardiovascular nursing by enabling proactive identification of high-risk patients through predictive analytics. Unlike traditional monitoring that responds to isolated readings, AI analyzes patterns across multiple data streams—vital signs, laboratory results, medication adherence, and patient history—to predict clinical deterioration before symptoms manifest.

A practical example of AI in managing complex cases is the use of predictive algorithms in heart failure management. AI systems can analyze patterns in vital signs and lab results to predict potential decompensations, prompting early interventions such as adjustments in medication or patient education[13]. Another example is AI-powered predictive analytics to identify patients at elevated risk for sepsis while caring for hospitalized patients with CVD. A recent study demonstrated that AI algorithms could predict sepsis up to 12 hours before clinical signs become apparent, enabling early intervention, and improving patient survival rates[14].

For population health management, AI addresses the challenge of monitoring large patient cohorts with limited nursing resources. With ongoing staffing shortages and a growing chronic disease burden, healthcare is shifting toward value-based, population-level care models. In this context, AI can help a small team of clinicians efficiently manage large cohorts by flagging unmet best-practice measures, identifying patients at risk, and reducing the need for full chart reviews of stable patients. For example, a cardiovascular nurse could use AI-driven dashboards to monitor trends in heart failure patients across a region or health system, flag those showing signs of decompensation, and initiate early interventions, thereby reducing hospitalizations and improving outcomes at scale. Transition of care programming is an excellent area to pilot these initiatives/tools.

Artificial Intelligence for Clinical Decision Support

Artificial intelligence technologies enable nurses to efficiently access and analyze large volumes of patient data to support clinical decision-making. For example, AI algorithms that integrate patient history, lab values, and imaging can assist nurses in recognizing patterns and guiding timely interventions, particularly in managing chronic conditions such as diabetes or heart failure. By leveraging these technologies, nurses can make more informed, collaborative decisions within complex care teams[15,16].

Furthermore, AI in clinical decision support systems integrates with EHR, helping nurses to access relevant evidence-based guidelines through decision prompts and apply them to patient-specific data in real-time. Artificial intelligence can also be used to assess the likelihood of adverse events, enabling nurses to prevent errors and take timely corrective actions for complex clinical management. For instance, the use of AI in assessing medication interactions and identifying potential drug errors has shown to reduce medication-related adverse events[17].

In addition, AI tools can also support nurses in case management. For example, AI-powered case management systems can track patient progress and predict potential barriers to recovery, such as social determinants of health or missed follow-up appointments. This predictive capability enables nurses to proactively address challenges in a patient's care plan, improving overall outcomes and reducing hospital readmission rates.

Artificial Intelligence for Cardiovascular Patient Education

Artificial intelligence is transforming cardiovascular patient education. For cardiovascular nurses, AI tools offer a powerful way to deliver personalized health information and support behavior change. These systems analyze a patient's data, learning preferences, and health literacy to create tailored educational content. Artificial intelligence-driven chatbots and virtual health assistants are especially promising. They provide 24/7 access to reliable health information, medication reminders, and coaching. For instance, a chatbot can guide a heart failure patient through daily symptom monitoring and provide personalized dietary advice[18]. These platforms can also adapt to a patient's learning style, offering infographics for visual learners or detailed text for others[19]. They track comprehension through quizzes and adjust content complexity as needed.

Predictive analytics within these platforms can identify patients at risk of not following treatment plans. This allows for targeted interventions, such as extra medication counseling for those showing declining adherence[20]. Artificial intelligence-enabled patient portals further empower patients by summarizing complex clinical data—such as lab results and vital signs—into easily understandable trends. Crucially, AI's language processing capabilities may help to overcome communication barriers. By providing real-time translation and culturally appropriate content, these tools may enhance equitable access to high-quality health education for diverse patient populations, thereby closing health disparity gaps.

Challenges and Barriers to Artificial Intelligence Implementation in Cardiovascular Nursing

Integrating AI into cardiovascular nursing holds significant promise to not only enhancing clinical care and improving patient outcomes but to streamlining workflows and optimizing administrative tasks[21]. However, as AI gains momentum, there are challenges and barriers that must be addressed to ensure adequate delivery of AI tools and the adoption of these technologies in clinical and nursing practice. The challenges include such issues as data quality and standardization, integration within existing healthcare settings, ethical and legal concerns, regulatory issues, and of upmost importance user acceptability and training[5]. As noted previously, AI plays a critical role in cardiovascular nursing, including supporting informed clinical decision-making, interpreting data, and detecting early warning signs in patients. It also enhances workflows by streamlining nurse-patient interactions, generating clinical notes, and populating electronic health records[5]. The main challenges and barriers of AI are highlighted in the next section to ensure that most issues are addressed in ensuring the safety and adequacy of these systems.

Data Quality and Standardization

Artificial intelligence needs diverse, large data sets to function properly. Often, due to inadequate documentation and varying terminologies, data formats across health care systems can hinder the process of developing accurate predictive models. All AI applications must be designed to address biases and potential disparities, and regular audits and ongoing monitoring must occur to mitigate biases and disparities[22].

Integration Within the Existing Healthcare Setting

Another barrier to implementation is the need to integrate AI into existing healthcare workflows, which often requires substantial redesign of clinical processes. This transformation demands time, resources, and a strong commitment to change across the organization. Ensuring interoperability between AI systems and the EHR, which may require infrastructure upgrades, is another challenge that must be overcome in clinical practice settings[23].

Ethical and Legal Concerns

Ensuring the privacy of patients, nurses, and others in developing AI systems is of upmost importance[24]. To ensure privacy, encryption systems are built into AI systems, patient consent must be obtained, and guidelines for the Health Insurance Portability and Accountability Act must be followed[25]. Regular audits must be performed to ensure privacy is achieved, and health care professionals must understand how algorithms reach conclusions and make decisions. Finally, these systems must be developed to address biases and ensure disparities are addressed[22,26]. An AI Bill of Rights handbook has been developed by the White House Office of Science and Technology Policy, which may help nurses familiarize themselves with privacy needs and concerns[27].

Regulatory Issues

Artificial intelligence systems lack prospective research and clinical trials to validate their safety and effectiveness. It is essential that AI systems use standardized platforms to report predictions and scaling findings. One of the main challenges in nursing is the quality and standardization of data. The current healthcare system often suffers from inconsistent, incomplete, and non-standardized documentation across systems and institutions. Developing regulatory frameworks, standards, and pathways for AI technologies is crucial to ensure safety and effectiveness in clinical practice[28].

Nursing User Acceptability and Training

Accepting AI as a solution to many issues in nursing and medicine comes with some lack of acceptability of this new technology[29]. This is often due to unfamiliarity of AI and the threats that many clinicians feel in observing their traditional roles. Thus, comprehensive training and education of all healthcare professionals is essential to help mitigate concerns within nursing and to promote acceptance. To help cardiovascular nurses accept AI, training must be thorough. Cardiovascular nurses can engage in ongoing education about AI through workshops, webinars, and courses focused on AI in healthcare. Fundamental to training is having nurses develop an understanding of AI concepts, which includes ML, NLP, and data analysis[5]. Nurses need to interpret and analyze large datasets to aid decision-making, like researchers. Managing EHRs and AI interfaces is crucial for accurate data input and effective use of AI in clinical settings. Nurses also need to be aware of privacy issues, algorithm biases, and the need to maintain human oversight in AI-assisted care. Finally, there are numerous stakeholders involved in AI development and implementation, which require nurses to communicate with interdisciplinary colleagues including computer scientists, ethicists, physicians, and other health care professionals[5,30]. Communicating with patients is also vital to ensure successful implementation and organization of AI tools in nursing practice[5,30].

While AI has both challenges and barriers to implementation, the early adoption of AI in clinical practice is here to stay. As cardiovascular nurses gain expertise in the use of AI, we will see gains in clinical practice expertise, employee efficiency, and better patient outcomes with the potential to revolutionize nursing practice and enhance patient care.

Call to Action in Cardiovascular Nursing

The rapid advancement of AI presents a pivotal moment for cardiovascular nursing, demanding proactive engagement to ensure these technologies enhance, rather than replace, nursing practice and patient-centered care. Cardiovascular nurses must spearhead the integration of AI, leveraging their indispensable clinical expertise and patient advocacy to guide the development, implementation, and ethical oversight of AI systems. This involves advocating for leadership roles in AI governance, ensuring that AI tools are designed to support holistic care, address potential biases, and genuinely improve clinical workflows and patient outcomes.

Successful AI integration hinges on robust collaboration and continuous learning. Cardiovascular nurses must actively partner with AI developers, data scientists, ethicists, and healthcare organizations to bridge the gap between technological capabilities and real-world clinical and patient needs. Professional bodies, such as the Preventive Cardiovascular Nurses Association and Association of Cardiovascular Nursing & Allied Professions, can champion these interdisciplinary efforts by facilitating educational initiatives that provide practical AI understanding and by fostering platforms for nurse-led innovation in AI-driven cardiovascular care solutions. This commitment extends to individual nurses, who must pursue ongoing professional development to effectively utilize and critique AI tools.

Establishing clear professional standards and advancing rigorous research are crucial. The cardiovascular nursing community must develop comprehensive guidelines for AI use, addressing ethical considerations, privacy, competency, and the necessity of human oversight. Concurrently, prioritizing research will validate AI's impact on nursing practice and patient outcomes, identify best practices for implementation, and drive quality improvement. Nurses' involvement in these research and standard-setting activities is vital to ensure AI tools are safe, equitable, and effective within diverse cardiovascular care settings.

Ultimately, cardiovascular nurses bear a professional and ethical responsibility to advocate for the responsible deployment of AI. This includes championing patient privacy, promoting health equity by scrutinizing AI for bias, and preserving the essential human connection in care. By collectively leading, collaborating, researching, standardizing, and advocating, cardiovascular nurses can harness AI's transformative potential to elevate their profession, optimize patient care, and secure a future where technology and compassionate nursing achieve superior cardiovascular health for all.

Conclusion

In conclusion, we are in an exciting era with explosive innovation from the development of AI tools. Cardiovascular nurses can benefit substantially if the right tools are developed and deployed to improve patient care. Artificial intelligence offers various possibilities for enhancing clinical care delivery and nursing practice. From enhancing decision-making with evidence-based support to reducing human error through real-time monitoring, AI can have a profound impact on current and future patient outcomes. There are numerous opportunities that currently exist with AI tools and many more that will likely be discovered as developers and multidisciplinary users engage in AI innovation. We must continue to be aware of the challenges with implementation and involve nurses to address the concerns. Nurses must be involved at every stage and help address barriers to AI use as clinicians and advocate for patient safety, even at the expense of efficiency. Importantly, as we advance AI-enabled nursing care, we will need to rigorously examine staff satisfaction and retention by nurses consistently utilizing AI in their practices[31]. We should also consider how AI solutions can reach patients and communities in low- and middle-income countries. There is much to consider in the call to action for cardiovascular

nurses with the primary charge to focus on delivering excellent nursing care to patients and communities in this new generation of AI-enabled healthcare.

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