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Review Article

Digital Health and Healthcare Informatics Using Artificial Intelligence: Implications for Contemporary Nursing Practice

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ABSTRACT

Digital health and healthcare informatics are rapidly transforming modern nursing practice, with Artificial Intelligence (AI) emerging as a major component of healthcare innovation. Nurses, as frontline healthcare professionals and primary users of digital technologies, increasingly interact with AI-enabled tools to support patient care, clinical decision-making, documentation, and care coordination. This review aims to examine the role of artificial intelligence in digital health and healthcare informatics and explore its impact on nursing practice across diverse healthcare settings. This review synthesizes existing literature on the application of AI in nursing and healthcare informatics. Key areas examined include AI-supported electronic health records, clinical decision support systems, telehealth, remote patient monitoring, predictive analytics, and population health management. The findings indicate that AI-driven technologies can significantly enhance nursing practice by improving workflow efficiency, reducing documentation burden, strengthening patient safety, and supporting evidence-based decision-making. AI also contributes to more personalized and proactive patient care through predictive analytics and remote monitoring. However, several challenges remain, including concerns regarding data privacy, algorithmic bias, transparency, accountability, and the digital competency of healthcare professionals. Artificial intelligence has significant potential to improve nursing practice and healthcare delivery within digital health environments. Successful implementation requires strong nursing leadership, adequate workforce training, and ethical oversight to ensure safe and effective adoption. Ongoing research and interdisciplinary collaboration are essential to maximize the benefits of AI while addressing emerging challenges in nursing practice and healthcare informatics.

Keywords: Artificial Intelligence, Clinical Decision Support, Digital Health, Healthcare Informatics, Nursing Informatics, Nursing Practice, Telehealth, Patient Safety.

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INTRODUCTION

Digital transformation has become a defining feature of contemporary healthcare systems, significantly influencing the organization, delivery, and evaluation of health services worldwide (Stoumpos *et al*., 2023). The widespread adoption of electronic technologies, interoperable data platforms, and digital communication tools has reshaped clinical workflows, healthcare management processes, and patient engagement strategies. Digital solutions are increasingly being used to address growing healthcare demands, workforce shortages, and the increasing complexity of patient care, particularly in settings characterized by aging populations and a rising burden of chronic diseases (Chen *et al*., 2024).

Within this evolving landscape, digital health has emerged as a broad framework that encompasses the use of information and communication technologies to support clinical care, disease prevention, health promotion, and health system strengthening (Abernethy *et al*., 2022). Digital health initiatives aim to improve the efficiency, quality, and safety of healthcare services while facilitating continuity of care across different settings. The integration of digital technologies has also enhanced access to health information, enabled real-time clinical documentation, and strengthened interdisciplinary collaboration, thereby contributing to more coordinated and patient-centered healthcare delivery (Erku *et al*., 2023).

Artificial Intelligence (AI) represents one of the most significant advancements within digital health and healthcare informatics.

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AI-based systems are capable of analysing large volumes of structured and unstructured health data, identifying complex patterns, and generating predictive or analytical insights to support clinical and administrative decision-making (Fahim *et al.*, 2025). In healthcare settings, AI applications have been increasingly adopted in areas such as clinical decision support, diagnostic assistance, risk prediction, patient monitoring, and workflow optimisation. Rather than replacing healthcare professionals, AI technologies are designed to complement professional expertise and enhance the effective use of health information in clinical practice (Maleki & Forouzanfar, 2024).

Nursing practice is closely linked to digital health and healthcare informatics, as nurses constitute the largest segment of the healthcare workforce and are among the primary users of health information systems (Livesay *et al.*, 2023). In routine practice, nurses regularly interact with electronic health records, medication administration technologies, clinical documentation systems, and patient monitoring platforms. These digital systems play a critical role in patient assessment, care planning, implementation of nursing interventions, and communication within multidisciplinary healthcare teams (Huter *et al.*, 2020). The incorporation of AI-enabled functionalities into these systems has the potential to support nursing practice by improving access to information, reducing documentation burden, enhancing the early detection of patient deterioration, and facilitating evidence-based clinical decision-making (Wei *et al.*, 2025).

Despite these potential benefits, the integration of artificial intelligence into nursing-related digital health systems presents important ethical, professional, and educational challenges. Concerns regarding data privacy and security, algorithmic bias, transparency of AI-generated recommendations, and accountability for clinical decisions have significant implications for nursing practice and patient safety (Chustecki, 2024). Nurses must remain vigilant in safeguarding patient rights while ensuring that AI-supported decisions are consistent with professional standards and ethical principles (Rony *et al.*, 2024). Furthermore, the effective use of AI technologies requires the development of competencies in digital literacy, critical evaluation of algorithmic outputs, and ethical decision-making. Without appropriate governance frameworks, targeted education, and professional oversight, the implementation of AI may introduce new risks alongside its anticipated benefits (Cao *et al.*, 2025).

Given the rapid expansion of artificial intelligence within healthcare systems, there is a growing need to understand its implications for nursing practice and healthcare delivery. Therefore, this review aims to synthesize current evidence on the role of artificial intelligence in digital health and healthcare informatics and to examine its implications for contemporary nursing practice. The review explores the application of AI-enabled technologies in nursing care, discusses associated ethical and professional considerations, and highlights future directions for nursing education, leadership, research, and practice. By critically examining both the opportunities and challenges of AI integration, this review seeks to provide an evidence-informed perspective on how artificial intelligence can be responsibly utilized to support safe, ethical, and high-quality nursing care across diverse healthcare settings.

METHODOLOGY

This narrative review was conducted through a comprehensive search of electronic databases including PubMed, Scopus, Web of Science, Google Scholar, and CINAHL. Relevant articles published primarily between 2020 and 2025 were identified using keywords such as "artificial intelligence", "digital health", "healthcare informatics", "nursing informatics", "telehealth", "clinical decision support", and "nursing practice". Peer-reviewed articles, systematic reviews, and relevant policy documents published in English were included. The selected literature was critically reviewed and synthesized to provide an overview of current applications, challenges, ethical considerations, and future directions of AI in nursing practice.

DIGITAL HEALTH AND HEALTHCARE INFORMATICS: A NURSING PERSPECTIVE

Healthcare informatics refers to the structured and purposeful application of information science, computer technologies, and analytical methods to support the collection, processing, storage, retrieval, and meaningful use of health-related data (Yogesh & Karthikeyan, 2022). Its primary objective is not merely the digitization of healthcare information, but the transformation of data into actionable knowledge that can support clinical decision-making, improve care quality, and enhance patient safety. Within this broader interdisciplinary field, nursing informatics has emerged as a distinct and essential specialty that integrates nursing science with information and communication technologies to advance nursing practice, education, administration, and research (McDonald et al., 2007).

From a nursing standpoint, healthcare informatics is fundamentally practice-oriented. Nurses occupy a central position in healthcare delivery and are among the most consistent and intensive users of digital health systems (Nashwan et al., 2025). They generate a substantial proportion of clinical data through ongoing patient assessment, documentation of care activities, monitoring of physiological parameters, and communication with multidisciplinary teams (Jim et al., 2020). As healthcare systems increasingly rely on digital platforms, nursing informatics plays a critical role in ensuring that technological innovations are responsive to the realities of bedside care, professional standards, and patient-centered values (Darvish et al., 2014). Informatics systems that fail to reflect nursing workflows or clinical priorities risk increasing workload, compromising data quality, and undermining patient safety (Shi et al., 2025).

Digital health and healthcare informatics, when viewed through a nursing lens, extend beyond technological infrastructure to encompass the ways in which information systems shape clinical reasoning, influence workflow efficiency, and mediate interactions among healthcare professionals and patients (Weissenfels et al., 2025). Nurses do not simply interact with digital systems as passive end users; rather, they actively interpret, contextualize, and act upon health information in dynamic and often complex clinical environments (Van et al., 2023). The success of digital health initiatives is therefore closely linked to how effectively informatics systems support nursing processes, clinical judgment, and professional autonomy (Al-Qudah et al., 2025).

Within nursing practice, digital health and healthcare informatics may be understood across three interrelated and dynamic domains. These domains are not discrete, but continuously interact to support comprehensive and coordinated care delivery (Gadd et al., 2020).

The first domain, data acquisition and management, involves the accurate and timely collection, documentation, storage, and retrieval of patient information. Nurses contribute substantially to this domain through routine clinical documentation, continuous patient monitoring, and recording of therapeutic interventions and patient responses (Ștefan et al., 2024). High-quality data are essential for continuity of care, interprofessional communication, and clinical decision-making. Artificial intelligence enhances this domain by supporting automated documentation processes, reducing redundancy, improving data completeness, and enabling integration across multiple digital platforms (Ng et al., 2025). AI-enabled systems can assist nurses by minimizing documentation burden while maintaining accuracy and standardization, thereby allowing greater focus on direct patient care (Michalowski et al., 2026).

The second domain, clinical decision support and analytics, focuses on transforming raw health data into meaningful clinical insights. AI-driven analytical tools are increasingly embedded within digital health systems to identify patterns, trends, and risk indicators that may not be readily apparent through manual review alone (Elhaddad & Hamam, 2024). For nurses, these tools can support early recognition of patient deterioration, identification of safety risks, and prioritization of care interventions (Lourenço et al., 2023). Clinical decision support systems grounded in evidence-based guidelines can reinforce best practices and reduce variability in care, particularly in high-acuity or resource-constrained settings (Chen et al., 2023; Shahmoradi et al., 2021). Importantly, these systems function as supportive mechanisms, enhancing nurses' situational awareness and clinical confidence without replacing professional judgment.

The third domain, care delivery and patient engagement, emphasizes the application of digital health technologies to support direct nursing care and foster active patient participation in health management (Barony et al., 2022). AI-enabled digital tools facilitate remote patient monitoring, personalized health education, and sustained communication between nurses and patients beyond traditional care settings. These capabilities are particularly relevant in chronic disease management, transitional care, and community health nursing, where continuity and patient self-management are essential (Dong et al., 2025). By supporting individualized care approaches and timely follow-up, digital health technologies contribute to improved patient experience and health outcomes.

Across all three domains, artificial intelligence functions as an adjunct to professional nursing judgment rather than a substitute for it. The interpretive, ethical, and relational dimensions of nursing care remain firmly rooted in human expertise, empathy, and accountability (Arcadi, 2025). AI systems are most effective when they are designed to complement nursing workflows, reduce cognitive burden, and support timely and informed clinical decisions. Achieving this balance is fundamental to the responsible integration of artificial intelligence within nursing-focused digital health and healthcare informatics and to sustaining the human-centered ethos of the nursing profession (Dailah et al., 2024).

ARTIFICIAL INTELLIGENCE IN ELECTRONIC HEALTH RECORDS AND NURSING DOCUMENTATION

Electronic Health Records (EHRs) constitute the core infrastructure of contemporary digital healthcare systems and are central to everyday nursing practice. Nurses are among the most frequent users of EHRs, relying on these systems to document patient assessments, interventions, care plans, and outcomes across all healthcare settings (Forde-Johnston et al., 2023). While the adoption of EHRs has improved accessibility to patient information, continuity of care, and interdisciplinary communication, it has also significantly increased the documentation burden placed on nurses. Excessive time spent on data entry has been associated with workflow inefficiencies, reduced time for direct patient care, and increased risk of professional burnout.

The integration of artificial intelligence into EHR systems represents an important advancement aimed at addressing these challenges. AI-enabled EHRs are designed not only to store and retrieve information but also to support nurses through intelligent data processing, automation, and clinical insight generation (Ye et al., 2024). From a nursing perspective, AI-enhanced EHRs function as supportive tools that streamline documentation processes, improve data quality, and facilitate timely clinical decision-making, while preserving the central role of professional judgment.

AI-Assisted Nursing Documentation

Nursing documentation is a critical component of patient care, serving legal, clinical, and communication purposes. However, traditional EHR documentation often requires structured data entry that may not align with nurses' natural clinical workflows. Artificial intelligence, particularly through Natural Language Processing (NLP) and voice recognition technologies, offers solutions to this longstanding challenge (Yadav, 2024).

AI-assisted documentation systems enable nurses to record patient assessments and care activities using narrative or voice-based inputs, which are then automatically translated into standardized, structured formats. This approach allows nurses to document care in a manner that more closely reflects clinical reasoning and real-time patient interaction. By reducing reliance on repetitive manual data entry, AI-supported documentation has the potential to significantly decrease charting time, improve accuracy, and enhance completeness of nursing records (Ju et al., 2025).

Importantly, these systems also support standardized nursing terminologies, which strengthens data consistency and facilitates quality monitoring, research, and outcome evaluation. From a professional standpoint, AI-assisted documentation supports nursing accountability while allowing nurses to allocate more time to direct patient care and therapeutic communication.

Clinical Data Interpretation and Nursing Surveillance

Beyond documentation, AI-enabled EHR systems play an increasingly important role in clinical data interpretation and nursing surveillance. Nurses continuously assess patient status by synthesizing multiple data sources, including vital signs, laboratory results, medication records, and observational findings (Al Khatib & Ndiaye, 2025). The volume and complexity of this data can exceed human cognitive capacity, particularly in high-acuity settings.

Machine learning algorithms embedded within EHR platforms can analyze large datasets in real time, identifying subtle patterns and trends that may not be immediately apparent to clinicians. These systems can generate alerts related to early signs of patient deterioration, such as changes in physiological parameters or deviations from expected recovery trajectories (Javed & Islam, 2025). For nurses, such insights support early recognition of clinical risk, timely intervention, and appropriate escalation of care.

Importantly, AI-driven clinical insights are intended to complement, not replace nursing judgement. Nurses remain responsible for contextualizing AI-generated information within the broader clinical picture, including patient preferences, psychosocial factors, and ethical considerations.

Interoperability and Care Coordination

Effective care coordination depends on timely, accurate, and accessible information exchange across healthcare settings. Fragmented information systems remain a significant challenge, often contributing to communication gaps during patient transfers and transitions of care. Artificial intelligence enhances interoperability by facilitating data integration across disparate digital platforms and clinical environments (Samal et al., 2021).

AI-supported interoperability enables seamless sharing of patient information between departments, institutions, and levels of care, ensuring that nurses have access to up-to-date and comprehensive patient data. This capability is particularly critical during admission, discharge, and referral processes, where incomplete or delayed information can compromise patient safety.

From a nursing perspective, improved interoperability supports continuity of care, reduces duplication of documentation, and minimizes the risk of errors related to incomplete information. By strengthening communication pathways, AI-enhanced EHR systems contribute to safer, more coordinated, and patient-centered nursing care.

CLINICAL DECISION SUPPORT SYSTEMS AND EVIDENCE-BASED NURSING PRACTICE

Clinical Decision Support Systems (CDSS) represent one of the most mature and clinically relevant applications of artificial intelligence within healthcare informatics, with direct and growing implications for nursing practice. These systems are designed to assist healthcare professionals by processing large volumes of patient-specific data and delivering context-sensitive guidance at the point of care (Sutton et al., 2020). Within nursing practice, CDSS are best understood not as autonomous decision-makers but as supportive tools that reinforce clinical reasoning, enhance situational awareness, and promote evidence-based decision-making.

For nurses, evidence-based practice requires the integration of clinical expertise, patient preferences, and the best available scientific evidence. AI-enabled CDSS contribute to this process by systematically synthesizing complex data from multiple sources, including electronic health records, laboratory investigations, physiological monitoring, medication profiles, and nursing documentation. Through machine learning algorithms and rule-based logic, these systems are able to recognize patterns, trends, and deviations that may not be immediately apparent during routine assessments, particularly in fast-paced or high-acuity care environments (Grechuta et al., 2024).

One of the most significant contributions of CDSS to nursing practice lies in the early identification of clinical risk and patient deterioration. AI-driven systems continuously analyze changes in vital signs, laboratory values, and nursing observations to generate alerts that prompt timely assessment and intervention (Rony

et al., 2024). For example, subtle trends indicating worsening respiratory function, hemodynamic instability, or infection risk may be detected before overt clinical symptoms develop. This supports nurses in initiating preventive measures, escalating care appropriately, and reducing the incidence of adverse events.

Clinical decision support systems are also widely applied to address nursing-sensitive outcomes, including falls, pressure injuries, and medication-related complications (Cordina et al., 2025). Risk prediction models can dynamically reassess patient vulnerability based on mobility status, cognitive function, nutritional indicators, skin integrity, and medication use. By providing real-time risk stratification, CDSS enable nurses to implement targeted preventive strategies, such as repositioning schedules, mobility assistance, or enhanced monitoring, in a proactive rather than reactive manner (Lam et al., 2026).

Medication safety represents another critical area where AI-enabled CDSS support nursing practice. Medication administration is a core nursing responsibility and a recognized area of patient safety risk. Decision support tools assist nurses by identifying potential drug–drug interactions, contraindications, dosing inconsistencies, and deviations from prescribed administration schedules (Graafsma et al., 2024). These systems function as an additional layer of safety, complementing nurses' pharmacological knowledge and reducing the likelihood of human error in complex clinical settings.

Beyond risk identification, CDSS play an important role in supporting adherence to clinical guidelines and standardized care pathways. By embedding evidence-based recommendations directly into nursing workflows, these systems help ensure consistency and quality of care while still allowing for individualized patient considerations. This is particularly valuable in environments characterized by high patient volumes, staffing constraints, and cognitive workload, where reliance on memory alone may compromise decision accuracy (Titler, 2008).

Importantly, the effectiveness of CDSS in nursing practice depends on appropriate system design, user engagement, and organizational support. Overreliance on automated alerts or poorly calibrated systems may contribute to alert fatigue, potentially diminishing clinical usefulness. Therefore, nurses must remain active and critical users of CDSS, applying professional judgment to interpret recommendations within the broader clinical context.

In summary, the integration of artificial intelligence into clinical decision support systems strengthens evidence-based nursing practice by enhancing clinical accuracy, supporting timely interventions, and reinforcing patient safety. When implemented thoughtfully and used in conjunction with professional expertise, AI-enabled CDSS contribute to improved quality of care while preserving the central role of nurses as accountable and reflective decision-makers within interdisciplinary healthcare teams.

Artificial Intelligence and the Nursing Process

The contribution of artificial intelligence to digital health and healthcare informatics can be clearly understood when examined through the lens of the nursing process, which remains the foundational framework guiding professional nursing practice. Rather than replacing this structured approach, AI-enabled systems function as supportive tools that enhance each stage of the nursing process while preserving the central role of clinical judgment and accountability (Santamato et al., 2024).

During the assessment phase, AI-supported digital health technologies facilitate comprehensive data collection and synthesis by aggregating information from electronic health records, monitoring devices, and patient-reported outcomes. This enables nurses to develop a more complete and timely understanding of patient status. In the nursing diagnosis phase, predictive analytics and decision support systems assist in identifying risk patterns and clinical priorities, supporting nurses in recognizing potential or emerging health problems.

In the planning stage, AI-driven insights contribute to individualized care planning by supporting risk stratification, prioritization of interventions, and alignment with evidence-based guidelines. During implementation, digital health platforms such as tele-nursing systems, automated reminders, and remote monitoring tools support the delivery of timely and coordinated nursing interventions. Finally, in the evaluation phase, AI-enabled analytics facilitate outcome tracking and feedback, allowing nurses to assess the effectiveness of interventions and modify care plans accordingly.

Across all stages of the nursing process, artificial intelligence enhances efficiency and situational awareness while reinforcing, rather than diminishing, the interpretive and ethical dimensions of professional nursing practice.

TELEHEALTH AND REMOTE PATIENT MONITORING IN NURSING CARE

The rapid expansion of telehealth and remote patient monitoring has significantly redefined the scope and delivery of nursing care across acute, primary, and community healthcare settings. Advances in digital connectivity, sensor technologies, and artificial intelligence have enabled the provision of nursing services beyond traditional clinical environments, facilitating continuous patient engagement and longitudinal care. For nurses, these developments have expanded professional responsibilities while simultaneously offering opportunities to enhance care quality, accessibility, and patient safety.

Telehealth and remote monitoring systems support nursing practice by enabling real-time assessment of patient health status, early identification of clinical deterioration, and timely intervention (Lin et al., 2024). AI-enabled digital platforms process large volumes of patient-generated health data,

transforming raw information into clinically meaningful insights that support nursing judgment. Importantly, these technologies do not replace the nurse–patient relationship; rather, they extend nursing presence and oversight into patients' homes and communities.

AI-Enabled Remote Monitoring

Remote patient monitoring systems, including wearable sensors and home-based digital devices, generate continuous streams of physiological and behavioral data such as heart rate, blood pressure, oxygen saturation, physical activity, and symptom reporting. Artificial intelligence algorithms analyze these data in real time to identify patterns, trends, and deviations from established individual baselines (Shajari et al., 2023). For nurses, this analytical capability supports early recognition of subtle changes in patient condition that may not be apparent during episodic clinical encounters.

AI-enabled monitoring systems facilitate proactive nursing interventions by generating alerts when predefined thresholds are exceeded or when predictive models indicate increased risk of clinical deterioration. This is particularly relevant in the management of patients with chronic conditions, post-discharge care, and vulnerable populations requiring close surveillance (Yuan et al., 2025). Nurses play a central role in interpreting algorithm-generated alerts, validating their clinical relevance, and initiating appropriate follow-up actions, including patient education, care coordination, or escalation to other healthcare professionals.

From a nursing perspective, remote monitoring supported by artificial intelligence enhances continuity of care, reduces preventable hospital readmissions, and strengthens patient self-management. However, it also requires nurses to develop competencies in data interpretation, digital communication, and ethical management of patient-generated health information.

Tele-nursing and Virtual Care

Tele-nursing represents a critical extension of nursing practice enabled by AI-supported telehealth platforms. Through synchronous and asynchronous virtual interactions, nurses conduct health assessments, provide patient education, monitor treatment adherence, and offer psychosocial support (Balenton & Chiappelli, 2017). Artificial intelligence enhances these platforms by assisting in patient triage, prioritization of care needs, and clinical decision support during virtual consultations.

AI-driven triage systems analyze patient-reported symptoms and health data to support nurses in identifying urgency levels and allocating care resources efficiently. During virtual encounters, decision-support tools offer evidence-based guidance, ensuring consistency and safety in nursing interventions (Tyler et al., 2024). These systems are particularly valuable in high-demand environments, where nurses must manage large caseloads while maintaining quality and timeliness of care.

Tele-nursing supported by artificial intelligence has demonstrated particular relevance in rural, remote, and underserved communities, where access to in-person healthcare services may be limited. By enabling continuous communication and follow-up, AI-enhanced telehealth platforms promote equity in healthcare access and support person-centered nursing care. Nevertheless, successful implementation depends on addressing challenges related to digital literacy, data privacy, professional accountability, and the preservation of therapeutic nurse–patient relationships in virtual settings.

BARRIERS AND IMPLEMENTATION CHALLENGES IN AI-ENABLED NURSING INFORMATICS

Despite the increasing incorporation of artificial intelligence into digital health and healthcare informatics, the translation of AI-enabled systems into routine nursing practice remains uneven and complex. While the potential benefits of artificial intelligence are widely acknowledged, multiple barriers continue to influence the effectiveness, acceptability, and sustainability of these technologies within nursing contexts. Understanding these challenges is essential to ensure that AI supports safe, ethical, and patient-centered nursing care rather than inadvertently disrupting clinical practice.

One of the most frequently cited challenges relates to workflow integration. Nursing work is inherently dynamic, requiring continuous prioritization, multitasking, and interpersonal engagement (Shan et al., 2023). AI-supported digital systems are often developed without sufficient consideration of the realities of bedside and community nursing practice. When AI tools are poorly aligned with established workflows, they may increase rather than reduce cognitive burden. Nurses may experience disruptions due to frequent system alerts, complex interfaces, or duplication of documentation tasks. In particular, excessive or non-specific decision-support alerts can contribute to alert fatigue, leading nurses to override or ignore system recommendations, thereby diminishing their intended clinical value (Lewandowska et al., 2020).

Workforce readiness and training limitations represent another major barrier to effective implementation. Nursing populations are diverse in terms of age, educational background, and prior exposure to digital technologies (Mabaso et al., 2025). Variability in digital literacy can influence nurses' confidence, attitudes, and willingness to engage with AI-enabled systems. Without adequate orientation and ongoing training, AI tools may be perceived as intrusive, time-consuming, or misaligned with professional nursing roles. This can foster resistance or passive underutilization, even when systems are technically functional.

In resource-constrained settings, limited access to structured training programs and continuing education further exacerbates these challenges, widening gaps in digital competency.

Infrastructure and resource constraints also play a critical role in shaping implementation outcomes. AI-enabled nursing informatics systems require reliable digital infrastructure, interoperable platforms, and sustained financial investment. In many healthcare settings, particularly in low- and middle-income countries limitations such as unstable internet connectivity, outdated hardware, and fragmented health information systems restrict the scalability and sustainability of digital health initiatives (Wei et al., 2025). These challenges are especially pronounced in community and primary healthcare environments, where nurses often deliver essential services with minimal technological support.

In addition to technical and organizational barriers, professional and cognitive concerns warrant careful consideration. Over-reliance on automated systems may inadvertently undermine clinical reasoning if AI-generated recommendations are accepted uncritically. Nursing practice is grounded in holistic patient assessment, contextual judgment, and ethical reasoning, dimensions that cannot be fully captured by algorithms alone (Ramadan et al., 2024). There is a risk that excessive dependence on AI outputs could narrow clinical focus or reduce nurses' confidence in their own professional judgment. Maintaining an appropriate balance between technological support and human expertise is therefore essential.

Addressing these barriers requires a multifaceted and participatory approach. Organizational leadership must demonstrate commitment to responsible AI integration through supportive policies, adequate resourcing, and realistic implementation timelines. Importantly, nurses should be actively involved in the design, selection, and evaluation of AI-enabled systems to ensure relevance to clinical practice (El Arab et al., 2025). Sustained investment in education, infrastructure, and change management is critical to fostering trust, usability, and long-term adoption. By acknowledging and addressing these challenges proactively, healthcare systems can better position AI as an enabler of nursing excellence rather than a source of professional disruption.

PREDICTIVE ANALYTICS AND POPULATION HEALTH NURSING

Predictive analytics is a key application of artificial intelligence in digital health, supporting a shift from reactive to preventive models of nursing care. By analysing large-scale clinical, demographic, and behavioural data, AI-driven predictive models generate forecasts of future health risks and outcomes.

In population health nursing, predictive analytics enables early identification of patients and communities at increased risk for disease progression, hospital readmissions, and care non-adherence. Integration of electronic health records, monitoring data, and social determinants of health enhances risk stratification and supports targeted, timely nursing interventions across acute and community care settings (Lee et al., 2020).

At the population level, predictive tools assist nurses in designing targeted health promotion strategies, improving resource allocation, and monitoring intervention outcomes. Additionally, nurse leaders can use predictive insights for service demand forecasting, staffing optimisation, and system-level planning.

However, predictive analytics must be applied with professional judgement, recognising the influence of data quality, bias, and ethical considerations. When implemented responsibly, predictive analytics serves as a decision-support mechanism that strengthens preventive, patient-centered, and equity-oriented population health nursing practice.

ETHICAL, LEGAL, AND PROFESSIONAL CONSIDERATIONS

The growing use of artificial intelligence in digital health has added new ethical, legal, and professional responsibilities to nursing practice. Although AI technologies can support efficiency and clinical decision-making, they also raise important concerns related to patient autonomy, accountability, and the need to preserve human-centred care. As frontline users of digital systems, nurses play a key role in ensuring that technology is used responsibly and in the best interests of patients (Naik et al., 2022).

Protecting patient privacy and confidentiality remains a core ethical obligation. AI systems rely on large volumes of sensitive health data drawn from electronic records and digital monitoring tools. Nurses must ensure that data are handled transparently and in accordance with legal and professional standards, as maintaining patient trust is fundamental to effective care (Abuhammad, 2025).

Concerns about algorithmic bias and a lack of transparency also require careful attention. AI tools may reflect existing inequalities within healthcare data, making it essential for nurses to critically interpret AI-generated recommendations. Clinical judgement, patient preferences, and contextual understanding must guide decision-making to ensure care remains fair and individualised (Cross et al., 2024).

From a legal perspective, responsibility for patient care continues to rest with healthcare professionals, even when AI is used to support decisions (Mennella et al., 2024). Clear institutional policies are necessary to define accountability and guide appropriate use of AI in practice.

Beyond direct care, nurses contribute to ethical leadership by engaging in policy development, governance, and quality improvement initiatives (El-Gazar & Zoromba, 2021). Their involvement helps ensure that AI technologies strengthen, rather

than compromise, safe, ethical, and patient-centered nursing practice.

NURSING EDUCATION AND COMPETENCY DEVELOPMENT

The effective, safe, and ethical use of artificial intelligence within digital health and healthcare informatics is fundamentally dependent on the preparedness of the nursing workforce. As AI-enabled technologies become increasingly embedded in everyday healthcare processes, the role of nurses is evolving beyond traditional clinical functions to include informed engagement with data-driven systems. This transformation requires the development of competencies that extend beyond conventional bedside skills and encompass digital literacy, analytical reasoning, ethical awareness, and professional adaptability.

Digital literacy has become a core competency for contemporary nursing practice. Nurses must be able to navigate electronic health records, interpret AI-generated alerts, and understand the limitations of algorithm-based recommendations. Equally important is the ability to critically evaluate AI-supported clinical outputs rather than accepting them uncritically (El-Banna et al., 2025). Nursing judgment remains central to patient care, and AI tools should be viewed as decision-support mechanisms that complement, rather than replace, professional reasoning. Developing confidence in interpreting data trends and recognizing when AI recommendations may not align with individual patient contexts is therefore essential.

Nursing education programs play a pivotal role in preparing future professionals for AI-enabled healthcare environments. The integration of nursing informatics, digital health principles, and foundational knowledge of artificial intelligence into undergraduate and postgraduate curricula is increasingly necessary (El-Banna et al., 2025). Educational approaches should prioritize applied learning, clinical relevance, and ethical reflection rather than technical programming skills. Exposure to real-world scenarios involving AI-assisted documentation, clinical decision support, and telehealth systems can help students develop practical competence and critical thinking skills.

Continuing professional development is equally important for the existing nursing workforce. Many practicing nurses completed their education before the widespread adoption of digital health technologies and may experience uncertainty or resistance when introduced to AI-supported systems. Structured training programs, mentorship, and ongoing institutional support are essential to build confidence and prevent digital skill gaps (El Arab et al., 2025). Leadership engagement is particularly important in fostering a supportive learning culture that encourages adaptation and professional growth.

In addition to technical and cognitive competencies, education and training must address the psychosocial dimensions of digital transformation. The increasing presence of technology in nursing work may contribute to stress, role ambiguity, or concerns about professional identity. Supporting nurses in adapting to evolving roles while reinforcing the humanistic foundations of nursing care is crucial. Competency development should therefore promote resilience, ethical sensitivity, and patient-centered values, ensuring that artificial intelligence enhances nursing practice without diminishing its relational and compassionate core.

GLOBAL PERSPECTIVES ON AI AND DIGITAL HEALTH IN NURSING

Artificial intelligence–enabled digital health technologies are increasingly recognized as valuable tools for strengthening nursing practice across diverse global healthcare settings. While the initial development and large-scale implementation of AI-based healthcare solutions have largely occurred in high-income countries, their potential contribution may be especially significant in low- and middle-income regions. These settings often face persistent challenges such as shortages of trained healthcare professionals, limited access to specialist services, geographic barriers, and fragmented health systems. Within such contexts, digital health innovations supported by artificial intelligence offer opportunities to enhance the reach, efficiency, and effectiveness of nursing care.

Tele-nursing platforms, mobile health applications, and AI-assisted triage systems have demonstrated particular relevance in extending nursing services to underserved and remote populations. Through virtual consultations, remote monitoring, and decision-support tools, nurses are able to maintain continuity of care beyond traditional clinical environments. AI-enabled systems can assist in the early identification of health risks, support symptom assessment, and facilitate timely referrals to appropriate levels of care (Haleem et al., 2021). These capabilities are especially valuable in community and primary healthcare settings, where nurses often serve as the first point of contact for individuals and families.

Nurses play a central role in the successful implementation and sustainability of AI-driven digital health initiatives at the community level. Their close engagement with patients and communities positions them to support technology adoption, promote health literacy, and ensure that digital tools are used in a manner that aligns with patient needs and expectations. In many global health contexts, nurses also act as educators and advocates, bridging gaps between technological systems and vulnerable populations.

Despite these opportunities, the global implementation of AI-enabled digital health technologies must be approached with careful consideration of contextual challenges. Significant variations exist in digital infrastructure, internet connectivity,

health system readiness, regulatory oversight, and workforce capacity across countries and regions. Additionally, differences in cultural beliefs, language, and health literacy can influence how digital health tools are perceived and utilized by patients (Mennella et al., 2024). Without adequate adaptation to local contexts, AI-driven solutions may fail to achieve their intended benefits or may inadvertently exclude certain populations.

In this regard, nurses serve as essential mediators between technological innovation and culturally appropriate care delivery. Their understanding of local health practices, social determinants of health, and patient preferences enables them to advocate for context-sensitive implementation strategies. Incorporating nursing perspectives into the design and evaluation of AI-enabled digital health systems is therefore critical to ensuring their relevance, acceptability, and ethical use.

Equitable access to digital health innovations remains a pressing global concern. The digital divide characterised by unequal access to technology, connectivity, and digital literacy poses a significant risk of exacerbating existing health inequities. Addressing this divide requires coordinated efforts involving policymakers, healthcare leaders, educators, and nursing professionals. Investment in infrastructure, workforce training, and supportive policies is essential to ensure that AI-enabled digital health systems contribute to inclusive and equitable healthcare delivery (Hadjiat, 2023). Ensuring that technological advancement aligns with the principles of social justice and patient-centered care represents a shared responsibility within the global nursing and healthcare community.

FUTURE DIRECTIONS FOR NURSING PRACTICE AND RESEARCH

As artificial intelligence continues to evolve within the broader domains of digital health and healthcare informatics, its sustained integration into nursing practice will require deliberate, evidence-informed, and nursing-led approaches. While early applications of AI have demonstrated potential benefits in clinical decision support, documentation efficiency, and patient monitoring, the long-term impact of these technologies on nursing practice remains insufficiently understood. Future directions must therefore be grounded in rigorous inquiry, professional reflection, and ethical stewardship.

From a research perspective, there is a pressing need for nursing-focused empirical studies that evaluate the effectiveness, safety, and acceptability of AI-enabled digital health systems. Much of the existing literature emphasizes technical performance or physician-centered outcomes, leaving gaps in understanding how these technologies influence nursing workflows and patient care processes (Alzghaibi, 2025). Future research should prioritize nursing-sensitive outcomes, including patient safety indicators, quality of care, continuity of care, workload distribution, documentation burden, and nurse well-being. Such outcomes are central to nursing practice and essential for evaluating whether AI technologies genuinely support, rather than hinder, professional care delivery (Gormley et al., 2024).

In addition, research should examine how AI-supported tools affect clinical judgment, professional autonomy, and the therapeutic nurse–patient relationship. As AI systems increasingly generate recommendations and alerts, it is important to understand how nurses interpret, trust, or challenge these outputs in real-world settings. Qualitative and mixed-methods research designs may be particularly valuable in capturing nurses' lived experiences, perceptions, and ethical concerns related to AI use across diverse clinical environments (Yıldız, 2025).

From a practice standpoint, the future of AI in nursing depends on meaningful nurse engagement in the design, implementation, and evaluation of digital health technologies. Nurses possess contextual knowledge of clinical workflows, patient needs, and care environments that is essential for ensuring that AI-enabled systems are practical, safe, and patient-centered. Involving nurses as co-designers and evaluators can reduce the risk of poorly aligned technologies that increase workload or disrupt care processes (Rony et al., 2024). Furthermore, strengthening nursing representation in digital health governance and policy-making structures will enhance accountability and promote ethical oversight.

Educational and pedagogical research also represents a critical future direction. Nursing education must evolve to prepare graduates who are confident and competent in navigating AI-enabled healthcare systems. Research is needed to identify effective strategies for integrating artificial intelligence, informatics, and digital ethics into nursing curricula and continuing professional development programs. Understanding how nurses acquire, apply, and sustain digital competencies over time will be central to workforce readiness and professional resilience in increasingly technology-driven healthcare settings (Wei et al., 2025).

Finally, future directions in nursing research must adopt a global and equity-oriented perspective. International and interdisciplinary collaborations are essential to evaluate the applicability of AI-driven digital health solutions across diverse healthcare systems, particularly in low-resource and under-served contexts. Attention must be given to infrastructure limitations, cultural considerations, and health literacy to ensure that AI innovations do not exacerbate existing health inequities. Ensuring that future developments in digital health remain inclusive, ethically grounded, and aligned with patient-centered nursing values should remain a guiding principle for both research and practice.

Table 1: Applications of Artificial Intelligence in Digital Health and Nursing Informatics.

Application Area	Description	Implications for Nursing
AI-enabled EHRs	Automated documentation and data analysis	Reduced workload and improved accuracy
Clinical Decision Support	Risk alerts and guideline-based recommendations	Enhanced patient safety
Remote Monitoring	Continuous patient data analysis	Early intervention and proactive care
Telehealth Platforms	AI-assisted virtual consultations	Expanded nursing care access
Predictive Analytics	Forecasting health risks	Improved care planning

CONCLUSION

Artificial intelligence is increasingly transforming the landscape of digital health and healthcare informatics, creating new opportunities to enhance nursing practice across diverse healthcare settings. As demonstrated throughout this review, AI-enabled technologies have become integral components of contemporary healthcare systems, supporting functions such as clinical decision-making, patient monitoring, health documentation, telehealth services, and population health management. These advancements offer considerable potential to improve the quality, efficiency, and accessibility of care while enabling nurses to deliver more evidence-informed and patient-centered services.

However, the integration of artificial intelligence into nursing practice is not solely a technological endeavor. The successful and responsible use of AI requires careful attention to ethical, legal, and professional considerations, including data privacy, algorithmic fairness, transparency, and accountability. While AI can provide valuable support for clinical practice, it cannot replace the critical thinking, clinical judgment, empathy, and interpersonal relationships that remain fundamental to nursing care. Nurses must therefore continue to play an active role in evaluating and contextualizing AI-generated information to ensure that healthcare decisions reflect individual patient needs and professional standards.

The literature further highlights the importance of preparing the nursing workforce for increasingly digital healthcare environments. Strengthening informatics competencies, promoting digital literacy, and fostering ethical awareness are essential to enabling nurses to engage confidently with emerging technologies. Equally important is the involvement of nursing leaders in the design, implementation, and evaluation of AI-driven health systems to ensure that these innovations align with the values and priorities of nursing practice.

As healthcare continues to evolve through digital transformation, nurses are uniquely positioned to contribute to the development and responsible application of artificial intelligence in clinical care. By combining technological innovation with the enduring principles of compassion, advocacy, and patient-centered practice, the nursing profession can help ensure that AI serves as a meaningful tool for improving health outcomes and advancing equitable, sustainable, and high-quality healthcare worldwide. Future research should continue to explore the long-term effects of AI integration on nursing practice, patient experiences, healthcare outcomes, and health system performance to guide evidence-based implementation and policy development (Table 1).

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ABBREVIATIONS

AI: Artificial Intelligence; **CDSS:** Clinical Decision Support Systems; **EHR:** Electronic Health Record; **NLP:** Natural Language Processing; **ICU:** Intensive Care Unit; **IoT:** Internet of Things; **mHealth:** Mobile Health; **WHO:** World Health Organization; **LMIC:** Low- and Middle-Income Countries; **RN:** Registered Nurse; **CPD:** Continuing Professional Development; **CRediT:** Contributor Roles Taxonomy; **CINAHL:** Cumulative Index to Nursing and Allied Health Literature; **ANN:** Artificial Neural Network; **ML:** Machine Learning; **RPM:** Remote Patient Monitoring.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS

Khushi Kansal: Conceptualization, Methodology, Writing - Original Draft, Writing - Review and Editing, Project Administration. **Partha Chowdhury:** Writing - Original Draft, Writing - Review and Editing, Validation. **Niranjan Kumar:** Writing - Original Draft, Writing - Review and Editing, Supervision. **Rajeev Trivedi:** Writing - Review and Editing, Resources, Validation. **Bhavana Rawat:** Writing - Review and Editing, Resources, Clinical Perspectives.

SUMMARY

This review highlights the expanding role of Artificial Intelligence (AI) in digital health and healthcare informatics, emphasizing its growing impact on nursing practice as nurses increasingly use

AI-enhanced tools such as electronic health records, decision support systems, telehealth, and remote monitoring platforms.

AI offers significant benefits in nursing by reducing documentation burden through automation, improving clinical decision-making with predictive analytics and early warning systems, and enabling more proactive, personalized care through telehealth and remote patient monitoring.

Key challenges to AI adoption include workflow disruptions, alert fatigue, limited digital literacy, inadequate training, infrastructure gaps, and ethical concerns such as algorithmic bias, data privacy, transparency, and accountability in AI-assisted decision-making.

Successful AI integration in nursing requires strong leadership, nurse involvement in technology design, investment in education and infrastructure, and a focus on ensuring AI supports not replaces professional nursing judgment while maintaining patient safety and equity.

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