

N.U.R.S.E.S. embracing artificial intelligence: A guide to artificial intelligence literacy for the nursing profession

Stephanie H. Hoelscher, DNP, RN, NI-BC, AIMP, CPHIMS, CHISP, FHIMSS^{a,*},
Ashley Pugh, MSHI, RN, CPHIMS^b

^a Hoelscher Department, School of Nursing, Texas Tech University Health Sciences Center, Lubbock, TX

^b Pugh Department, Quality Management Research Group, National Committee for Quality Assurance, Washington, DC

ARTICLE INFO

Article history:

Received 30 September 2024

Received in revised form 9 May 2025

Accepted 5 June 2025

Available online 24 June 2025

Keywords:

Nursing education

Digital health literacy

AI literacy

Healthcare technology

Informatics

Workforce development

ABSTRACT

Artificial intelligence (AI) is reshaping health care, making AI literacy vital for nursing professionals. The Navigate AI basics, Utilize AI strategically, Recognize AI pitfalls, Skills support, Ethics in action, and Shape the future framework provides a structured approach to AI integration into nursing. Nurses need to understand AI's fundamentals and its impact on clinical practice and patient care, both in the classroom and at the bedside. Nurses can use AI effectively and responsibly by recognizing benefits, such as enhanced decision-making, and challenges, like biased data. Ethical considerations should guide AI usage in health care, with a commitment to frequent skill development. Nurses play a pivotal role in shaping the future by ensuring AI is applied to benefit their organizations and, more importantly, healthcare workers and patients. This AI literacy guide is designed to empower nurses to navigate and help build the future of health care and AI with confidence and competence.

© 2025 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC license (<http://creativecommons.org/licenses/by-nc/4.0/>).

Introduction

As artificial intelligence (AI) continues to reshape health care, it is not enough for nurses to merely understand what AI is; they must be prepared to lead its responsible integration and maintain a working knowledge as it updates and evolves. While foundational knowledge remains essential, the greater challenge lies in addressing how gaps in AI literacy affect the nursing professional's ability to lead, innovate, and influence health and health equity. Nurse leaders in practice, education, and research face mounting pressure to guide their teams through technological transformation while safeguarding ethical standards, clinical excellence, and patient-centered care. To support this charge, Navigate AI basics, Utilize AI strategically, Recognize AI pitfalls, Skills support, Ethics in action, and Shape the future (N.U.R.S.E.S) offers a leadership-oriented framework for advancing AI literacy across all levels of nursing (Figure 1). Each component has been defined to reflect the strategic responsibilities of our leaders, varying in the evolving digital landscape.

Navigate AI Basics

Promote Basic Understanding of AI Among Nurses as a Leadership Responsibility

"The important thing is not to stop questioning. Curiosity has its own reason for existing."

Albert Einstein

Nurse leaders must recognize that foundational AI literacy is a matter of patient safety, not an optional skill. Gaps in basic understanding can result in the misuse of AI tools, misinterpretation of AI outputs, and a loss of trust from patients. Educational leaders have the responsibility to stay informed and advocate for the integration of AI into nursing curricula and training programs as applicable. Likewise, research leaders must address the risks posed by AI illiteracy, including flawed study designs and inadequate evaluation of emerging technologies, especially when these tools have a direct impact on patient care. Along with various ethical issues, there is, of course, the upside—all the wonderful things AI can do for nurses and patients.

Understanding the Foundations of AI and AI Literacy

AI literacy in health care encompasses the foundational knowledge, technical competencies, and ethical awareness required to understand,

* Corresponding author: S.H. Hoelscher, Hoelscher Department, School of Nursing, Texas Tech University Health Sciences Center, 3601 4th Street, MS 6264, Lubbock, TX 79430.

E-mail address: stephhoelscher@outlook.com (S. Hoelscher).

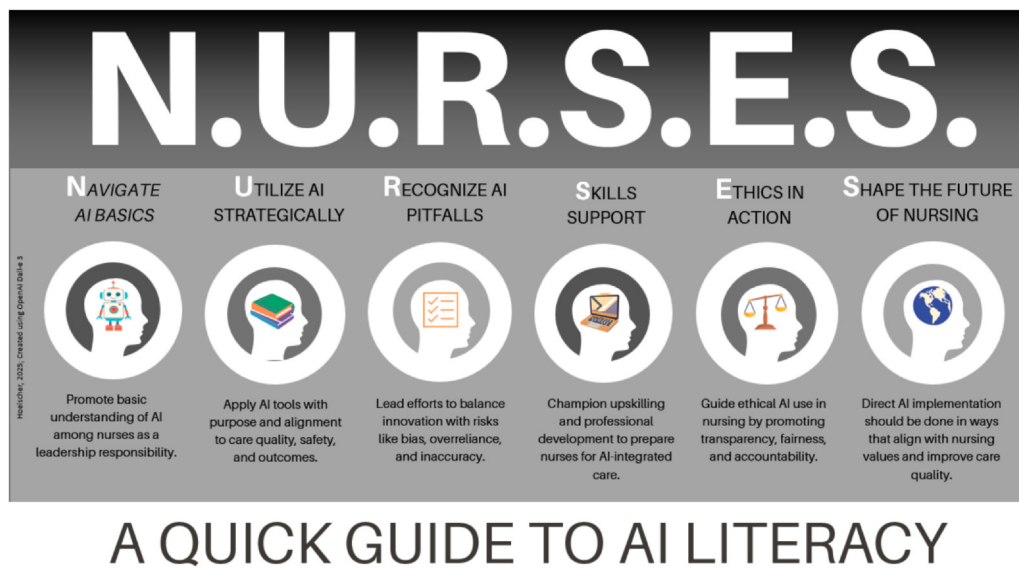


Figure 1. Quick guide to AI literacy for nurses. AI, artificial intelligence.

critically evaluate, and effectively apply AI technologies in clinical and educational contexts. Rather than offering a singular definition, AI literacy is increasingly understood as a multidimensional, multimodal competency that includes comprehension of AI principles, awareness of social and ethical implications, proficiency in interpreting AI-driven outputs, and the ability to integrate these tools into clinical workflows (Kimiafar et al., 2023; Long & Magerko, 2020). Defined as a “set of competencies that enable individuals to evaluate AI technologies critically; communicate and collaborate effectively with AI; and use AI as a tool online, at home, and in the workplace” (Long & Magerko, 2020, p. 2), AI literacy falls under the broader umbrellas of digital literacy and digital health literacy, but demands deeper engagement with emerging technologies such as machine learning, natural language processing, and neural networks (Table 1). For nurses and other healthcare professionals, foundational AI literacy enables not only technical fluency but also the critical ability to assess tools for safety, bias, and clinical relevance; skills that are essential for protecting patient outcomes and promoting ethical practice in a rapidly evolving digital environment.

While the history of AI is marked by decades of theoretical advancement, its relevance to health care today lies less in chronology and more in capability. AI is actively reshaping healthcare delivery by supporting clinical decision-making, automating routine tasks, and reducing documentation burden. However, the promise of AI is only as strong as the literacy supporting its use. Familiarity with how AI is developed, trained, and deployed, including understanding the data behind it, positions nurses to advocate for safe implementation, participate in interprofessional collaboration, and contribute to shaping the future of care. Rather than focusing on historical milestones alone, a practical understanding of AI functionality allows nurses to engage meaningfully with these tools (see Supplemental Material 1: AI Milestone Timeline Infographic). As AI continues to integrate across healthcare systems, equipping professionals with core AI literacy is critical to ensuring equity, safety, and informed innovation.

Utilize AI Strategically

Apply AI Tools With Purpose and Alignment to Care Quality, Safety, and Outcomes

“If you can’t describe what you are doing as a process, you don’t know what you’re doing.”

W. Edwards Deming

Strategic use of AI requires that nurse leaders vet tools for their relevance and fit within a given workflow. This includes possibly collaborating with nurse informaticists, researchers, educators, vendors, information technology, and interdisciplinary clinical teams to ensure that solutions are safe, usable, and aligned with nursing care models. For education, this means helping future nurses connect AI to clinical reasoning. In research, strategic utilization includes evaluating AI’s role in addressing disparities or inefficiencies in care delivery.

AI’s precision significantly reduces the potential for human error (note related hallucination discussion shortly). By automating routine tasks such as medication management, scheduling, and data entry, AI systems minimize the chances of errors that can occur due to fatigue or oversight in manual processes (Ahmed, 2024; Kimiafar et al., 2023). These systems ensure that essential processes are carried out with high accuracy, thus enhancing the overall quality of care.

Examples of AI Technology Usage in Health Care

Nurses with strong AI and digital health literacy skills can use AI effectively in many ways, such as educating patients using digital health tools like patient portals or health applications on their mobile devices. This education helps patients access their health information, engage actively in their care, and manage their health conditions more effectively (Nutbeam, 2023). Nurses can enhance patient empowerment and improve health outcomes by guiding patients and each other with these tools. Refer to Figure 2 for a mind map of more key AI-related healthcare technologies.

Diagnostics and Data-Driven Insights

One of the most notable benefits of AI in health care so far is its ability to enhance diagnostic accuracy. With the ability to analyze data quickly, AI can identify patterns that may not be apparent to humans (Ahmed, 2024; Hoelscher et al., 2024). For example, AI-powered diagnostic tools can quickly analyze medical images or test results (e.g., dermatology images of nevi for melanoma, mammograms, etc.), fostering early diagnosis, reducing the likelihood of misdiagnoses, and increasing accuracy. Overall, AI’s ability to analyze complex data sets enhances patient outcomes, especially in complicated cases, and there is strong evidence that it also improves the accuracy and efficacy of treatment planning (Adegboye, 2024; Ahmed, 2024; Kimiafar et al., 2023; Ross et al., 2024).

Table 1
Important Terminology and Concepts Around AI Literacy

Terminology	Definition
AI agents	"AI agent" has recently emerged as a term to describe an AI-powered system that assists patients with medical tasks like answering questions, monitoring health, and providing care guidance. This is not to be confused with the nursing specialty, "virtual nurse."
AI literacy	Understanding, using, and critically evaluating AI applications. It involves recognizing AI, grasping how it works, using AI tools responsibly, and assessing their implications.
AI nudging	Refers to the use of AI to deliver personalized, adaptive prompts that guide users toward healthier behaviors, like medication adherence. Can be used unethically to restrict choices or alter incentives (Sumner et al., 2023).
Algorithm	A set of instructions that a computer can follow to perform a task or solve a problem.
Ambient listening	Also known as ambient voice technology, AI dictation-like services that integrate natural language into the electronic health record conversation (Owens et al., 2024).
Augmented reality	Overlays digital content, like images or information, onto the real world through devices like smartphones or AR glasses, enhancing the user's perception of their environment. Often used for simulation education.
Big data	A large volume of data can be analyzed to reveal patterns and trends.
Digital health literacy	Digital health literacy includes the same concepts as health literacy but also adds the ability to use digital tools and platforms to access and manage health information.
Digital literacy	Skills and competencies needed to understand and function in a modern technological society.
eHealth literacy	eHealth literacy is the ability to seek, find, understand, and appraise health information from electronic sources and apply this knowledge to address or solve a health problem. It combines traditional literacy and numeracy with digital literacy skills.
Generative AI (GenAI)	GenAI refers to systems that can create new content, such as text, images, or even treatment suggestions, based on patterns they have learned from existing data.
Large language models	AI trained on vast text data to understand and generate human language, enabling tasks like answering questions, summarizing, and translating.
mHealth	mHealth refers to using mobile devices, such as smartphones and tablets, to support public health and clinical practice. This includes health apps, wearable devices, and mobile telehealth services. mHealth can enhance patient engagement, support remote monitoring, and provide health education.
Multimodal	AI systems that can process and understand multiple types of data, such as text, images, audio, or video, and combine them to generate more comprehensive responses or insights.
Neural networks	AI modeled after the human brain, which processes data through layers of interconnected nodes to recognize patterns and make decisions.
Prompt engineering	Using a "prompt" to create specific inputs into GenAI. The AI can interpret the input according to its data and produce an output for the requester.
Small language model	AI trained on less data with fewer parameters, making it faster but less capable than large models for complex tasks.
Upskilling	The act of preparing the workforce with skills and education to empower them to use AI to do their jobs (IBM, 2024, p. 2).
Virtual nursing	Nursing specialty that provides remote care and support through digital platforms like video calls or apps.
Virtual reality	Technology that creates a simulated, immersive environment, typically experienced through a headset, allows users to interact with 3D virtual worlds. Often used in simulation education.

Note. 3D, three-dimensional; AI, artificial intelligence; AR, augmented reality.

This table integrates concepts from various sources to present a comprehensive overview (Anders, 2023; Fiore, 2024; Hoelscher et al., 2024).

Leveraging AI for data-driven insights enables nurses to develop more informed care plans. By analyzing patient data in real time, AI tools provide actionable insights that help predict patient outcomes and suggest appropriate interventions. This capability allows for more personalized and efficient patient care, particularly in managing chronic conditions or preventing adverse events (Adegboye, 2024; Hoelscher et al., 2024).

Clinical Decision Support (CDS) and Predictive Analytics

AI-enhanced CDS and health data-driven predictive analytics are used to identify patients at risk for adverse outcomes, providing real-time recommendations and alerts to healthcare providers (Al Khatib & Ndiaye, 2025; Hoelscher et al., 2024; Ross et al., 2024). AI algorithms and predictive models can analyze vast datasets and provide evidence-informed recommendations to clinicians, aiding them in making informed decisions. This can lead to more accurate diagnoses, personalized treatment plans, and improved patient outcomes, ultimately reducing the burden on frontline practitioners, faster and more accurately than previous versions of CDS (Gandhi et al., 2023; Hobensack et al., 2024; Ross et al., 2024).

Robotics and Nursing Practice

The integration of robotics powered by AI is transforming nursing practice, particularly in surgical care, patient monitoring, and burden reduction. AI-enhanced robotic systems enable precision and consistency in minimally invasive surgeries, offering improved dexterity and reduced recovery times (Yelne et al., 2023). These robotic assistants are not intended to replace nurses or physicians but to augment clinical performance by reducing workload and increasing procedural accuracy. In clinical settings, AI-driven robotics also supports nurses in patient handling and routine task automation, allowing nurses to focus more on complex care needs and patient engagement. Robotic innovations illustrate the evolving

collaboration between human judgment and machine precision, signaling a shift in nursing roles toward more supervisory and technologically integrated functions (Yelne et al., 2023). For example, Moxi (Diligent Robotics Austin, Texas, USA), a socially intelligent robot, helps with many non-patient-facing tasks such as delivering lab samples, medications, and patient supplies (<https://www.diligentrobots.com/moxi>). According to its parent company, Diligent Robotics, Moxi is designed to adapt to changes in clinical workflow by learning from and collaborating with humans. There are also now social or companion robots, such as Sony's robotic puppy, Aibo (Sony Group Corporation, Japan; New York City, US) (<https://us.aibo.com/>), used in caring for older populations of patients as well as enhancing overall mental health (Al Khatib & Ndiaye, 2025).

Genomics, Precision Health, and AI in Nursing

AI plays a pivotal role in advancing genomics and precision health by enabling the rapid analysis of vast and complex genetic datasets. AI algorithms can identify patterns and correlations within a patient's genetic profile, medical history, and lifestyle data to support the development of individualized treatment strategies (Yelne et al., 2023). These tools are foundational to precision medicine, offering clinicians evidence-based recommendations tailored to each patient's unique biological and clinical characteristics. While the interpretation of genomic data is typically led by specialists such as genetic counselors and researchers, nurses play an important role in patient education, care coordination, and ensuring ethical considerations, such as informed consent and data privacy, are upheld. As AI-integrated genomic tools become more embedded in health care, there is growing potential for nurses to contribute more directly to interdisciplinary teams that apply genomic insights in nursing practice. Preparing nurses for this future will require enhanced education in genomics and data literacy to effectively support personalized care strategies informed by AI.

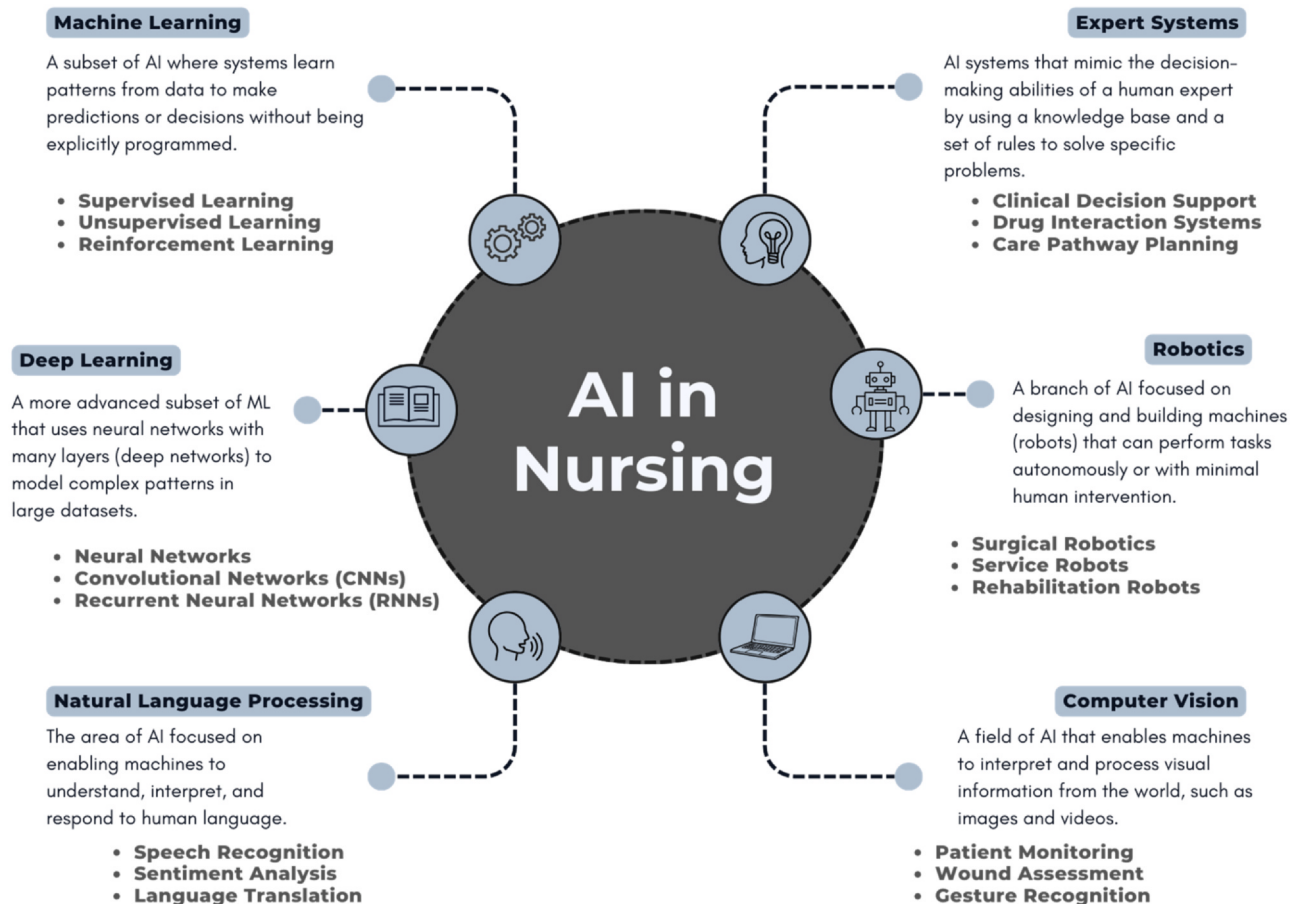


Figure 2. Key AI-related technologies in health care. *This figure integrates concepts from various sources to present a comprehensive overview (Anders, 2023; OpenAI, 2024; Sullivan et al., 2024). AI, artificial intelligence.

AI-Enhanced Simulation in Nursing Education

Simulation-based learning has long been a staple in nursing education, and the integration of AI is enhancing its realism, adaptability, and educational value. AI-driven simulation platforms can dynamically adjust patient scenarios based on learner performance, providing more personalized and responsive training experiences (Castonguay et al., 2023). These platforms simulate complex clinical conditions, enable real-time feedback, and facilitate the development of critical thinking and decision-making skills. Additionally, generative AI (GenAI) can support debriefing by generating summaries of student actions and suggesting alternative interventions. AI-enhanced simulation fosters experiential learning, allowing nursing students to safely explore high-risk scenarios and refine competencies before entering clinical practice. This evolution aligns with the growing need to prepare nurses for AI-integrated healthcare environments, where clinical judgment must be exercised in collaboration with intelligent systems (Castonguay et al., 2023).

Remote Patient Monitoring and Care

One of the most impactful applications of AI in this domain is through wearable devices and AI-enhanced remote monitoring systems (Al Khatib & Ndiaye, 2025; Hoelscher et al., 2024; Shaw, 2023). These tools can continuously track patient vitals, such as heart rate, oxygen saturation, and mobility patterns, enabling early detection of clinical deterioration. AI algorithms can identify subtle patterns in these data and predict events like heart failure or respiratory decline, prompting timely interventions before emergencies occur (Ahmed, 2024; Long & Magerko, 2020; Ross et al., 2024).

Together, these technologies hold significant promise for home care nursing, especially as patient acuity in outpatient and aging-in-place care models increases. AI monitoring devices allow nurses to maintain oversight of patients remotely, reducing hospital readmissions and enabling earlier intervention. This hybrid model of care delivery supports patient autonomy, enhances safety, and allows nurses to extend their clinical reach without being physically present, marking a critical evolution in community and home-based nursing practice.

Burden Reduction

AI is transforming documentation processes through ambient listening technologies, AI agents, virtual nursing, and more. These systems, sometimes integrated with voice recognition tools, automatically record patient/clinician interactions and generate summaries or documentation (Adegboye, 2024; Hoelscher et al., 2024; Owens et al., 2024; Ross et al., 2024). This has the potential to significantly reduce the documentation burden on nurses and other healthcare professionals, allowing them to spend more time focused on direct patient care. The efficiency gains AI provides in these areas may also improve operational workflows.

Administrative Efficiency

AI also plays a crucial role in improving the administrative efficiency of healthcare systems. One area where AI has made significant strides is in scheduling and resource management (Hoelscher et al., 2024). Traditionally, healthcare facilities have relied on manual processes for managing staff schedules and allocating resources, which can be inefficient and prone to errors. AI-driven

systems can now analyze data related to patient volumes, staffing levels, and available resources to optimize scheduling in real time, ensuring that hospitals and clinics are appropriately staffed based on current and projected demand. AI also contributes to time efficiency in nursing by automating routine administrative and clinical tasks (Ahmed, 2024; Hoelscher et al., 2024; Ross et al., 2024).

Recognize AI Pitfalls

Lead Efforts to Balance Innovation With Risks Like Bias, Overreliance, and Inaccuracy

“A bad system will beat a good person every time.”

W. Edwards Deming

Nurse executives and policy leaders must anticipate and mitigate AI-related harms, especially algorithmic bias, unequal access, and hallucinated data. Nursing leaders have a unique lens on how biases in data or tech design can contribute to health disparities. They are positioned to advocate for specific frameworks, engage in vendor conversations, and ensure real-world pilot testing reflects diverse populations. Researchers also play a vital role in bias detection, highlighting the significance of inequalities in system outputs.

Challenges and Risks

While leveraging AI systems to analyze patient data in real time is an advantage over current CDS and predictive analytics tools, the key observation here is the concept of “real-time.” Not all systems have interfaced with vital sign machines. Not all vital signs are documented in real time at the point of care. Accurate, up-to-date data entry is essential for quick diagnoses and detecting patient deterioration, but errors or delays can lead to serious issues (Naik et al., 2022). Years of inaccurate or redundant data entry have compounded the number of potential patient data issues in electronic health records (EHRs) or other health data sets.

Data Privacy and Security

Data privacy and security are paramount in the digital era. AI systems process large amounts of sensitive patient information, and the risk of data breaches or hacking is ever-present (American Nurses Association [ANA] Center for Ethics and Human Rights, 2022; Hoelscher et al., 2024; Olawade et al., 2024; Ross et al., 2024). Ensuring strong cybersecurity measures and maintaining the confidentiality of patient data is paramount to protect against unauthorized access and breaches that could have severe legal ramifications and financial loss to an institution (Naik et al., 2022). Ultimately, nurses need to recognize that protecting patient information is more important than ever as AI advances in health care. Beyond basic data privacy practices like avoiding phishing attacks (tricking you into giving sensitive information, often via email/text), it is important to stay aware of new risks AI can introduce, such as more sophisticated data breaches or misuse. Safeguarding data is a technical and ethical responsibility that is not new to the nursing profession. However, introducing AI capabilities will impact patient trust and maintaining compliance with regulations as technology evolves (ANA Center for Ethics and Human Rights, 2022; Hoelscher et al., 2024).

Algorithmic Bias

One of the significant challenges associated with AI in nursing is addressing inaccuracies and biases in AI algorithms (algorithmic bias) (Adegboye, 2024; ANA Center for Ethics and Human Rights, 2022; Glauberman et al., 2023; Kimiafar et al., 2023; Naik et al., 2022; Obermeyer et al., 2019; Perchik et al., 2023). AI systems are

only as good as the data they are trained on, and if that data are inaccurate or biased, the AI's outputs will be as well. These biases, often rooted in nonrepresentative training data or system inequities embedded in the EHRs, can perpetuate disparities in care. For example, algorithms trained on skewed datasets have been shown to allocate fewer healthcare resources to Black patients despite equal or greater need (Anders, 2023; Nazer et al., 2023; Obermeyer et al., 2019; Seneor & Mezzanotte, 2022). Preventing this requires active nurse involvement in developing and evaluating AI tools, including advocating for using diverse datasets, participating in model training, and standardizing data entry practice to minimize variance and bias (Hoelscher, 2025; McGrow, 2025).

Algorithmic bias can also occur when patients receive unequal care or are misdiagnosed due to sociodemographic factors embedded in clinical data, often reflecting underlying practitioner bias (Nazer et al., 2023; Seneor & Mezzanotte, 2022). This type of bias is measurement or classification bias. Nazer et al. (2023) discuss an example of a study that shows women are less likely than men to receive lipid-lowering medications or inpatient procedures, even though they may be more likely to present with conditions such as hypertension or heart failure. When AI models are trained on such biased data, they may falsely learn that men are at higher risk for cardiac disease and disproportionately recommend lipid-lowering treatments to male patients, thus reinforcing existing inequities.

Pursuit of Health Equity

The integration of AI into nursing practice presents both a powerful opportunity and a critical responsibility to advance health equity across diverse patient populations. Cary et al. (2024) propose an educational framework to prepare nurses for the ethical and effective use of AI in clinical practice and research, with a central focus on advancing health equity. It emphasizes that nurses, given their frontline roles and deep understanding of patient needs and social determinants of health, are uniquely positioned to ensure AI is applied in ways that reduce, rather than reinforce, health disparities. However, achieving this requires targeted training in AI literacy, data interpretation, algorithmic bias, and cultural humility.

While AI has the potential to personalize care, identify at-risk populations, and optimize resources, it can also perpetuate systemic biases if trained on nonrepresentative, diverse data. Nurses are called to act as evaluators, interpreters, communicators, and advocates who can ethically apply AI, particularly for marginalized populations (Cary et al., 2024). Integrating AI into nursing education, including simulation, case-based learning, and interdisciplinary collaboration, can be used as a key strategy to promote social justice and equitable healthcare outcomes in the digital era.

Hallucinations and Confabulations

AI systems in health care pose unique challenges, mainly through hallucinations and confabulations, terms describing the generation of inaccurate or fabricated information by AI. These issues are significant in healthcare settings, where real-time, accurate information is crucial for patient care. Hallucinations occur when AI produces factually incorrect or misleading outputs, while confabulations happen when AI fills gaps with plausible-sounding but false information. Both can result in dangerous consequences, such as incorrect diagnoses, inappropriate treatment recommendations, and racial or cultural biases. These notable issues are often complex to detect because they appear accurate or convincing (Sui, Duede, Wu, & So, 2024; Williamson & Prybutok, 2024). Any system's errors can undermine trust in AI and impact patient safety. Developers or vendors ensuring transparency in how AI makes decisions is essential, allowing providers to trace and verify outputs.

Skills Support

Champion Upskilling and Professional Development to Prepare Nurses for AI-Integrated Care

"An investment in knowledge always pays the best interest."

Benjamin Franklin

Upskilling is not an option; it is a strategic imperative. Upskilling is defined as "the act of preparing the workforce with skills and education to empower them to use AI to do their jobs" (IBM, 2024, para. 2). Nurse leaders in clinical settings must support structured, funded, and protected time for staff education on AI systems, especially during implementation. Faculty leaders must assess nursing programs and integrate AI competencies into undergraduate and graduate education. Research and translational science nurse leaders can help identify best practices in education delivery, evaluating the impact of AI literacy training on safety and job satisfaction.

Commitment to Continuous Learning

According to Lawry (2021), "the first thing to recognize about AI is that it creates a true paradigm shift in how data and IT systems add value" (p. 337). Promoting AI literacy in nursing requires a multifaceted approach. Nursing education programs should integrate AI literacy into their curricula, covering the basics of AI, its applications in health care, and the ethical considerations involved. Practical training sessions using AI tools can help students gain hands-on experience. For practicing nurses, continuing education programs should offer courses on AI literacy to keep them updated with the latest technological advancements. Workshops, webinars, and online courses can effectively provide this training. Additionally, healthcare institutions should develop policies that support the responsible use of AI, ensuring that ethical guidelines are followed and patient privacy is protected. These policies should also address the need for ongoing training and support for healthcare professionals using AI tools.

Collaboration and Networking

As AI continues to evolve, nurses who are literate in AI will be better prepared to adapt to new technologies and workflows, ensuring they remain effective in their roles (Long & Magerko, 2020). Collaborative learning can be crucial to aiding nurses in progressive AI literacy. Encouraging collaboration between nursing professionals and other specialties, such as academia, research, informatics, simulation, robotics, data analytics, and ethics, can foster a comprehensive understanding of AI. Interdisciplinary learning experiences can help nurses appreciate the broader context of AI integration in health care (Hoelscher et al., 2024; Narayanan et al., 2023).

Nursing professional organizations are also key to taking the lead and helping guide the profession into the AI era. Here are some current efforts by leading organizations regarding their position statements, policies, or recommendations on AI (Google, 2024):

- **American Academy of Nursing (AAN):** The AAN has formed an expert panel to evaluate AI's impact on nursing practice and develop recommendations for its responsible application (https://cdn.ymaws.com/aannet.org/resource/resmgr/policydocuments/2024policyactions/NAM_AI_Code_of_Conduct_Lette.pdf).
- **ANA:** The ANA Center for Ethics and Human Rights issued a position statement promoting the ethical use of AI in nursing, emphasizing principles for its safe and responsible integration. The organization also develops specific guidelines for using AI tools in clinical settings (2022).

- **Health Information Management Systems Society:** The 5 Rights of AI in Healthcare is a nurse-led model that aims to guide healthcare organizations in the safe and effective use of AI. When AI technologies are applied systematically and effectively, optimal, safe, and compassionate patient outcomes can be achieved. The 5 Rights consist of the right objective (problem and population), approach (workflow and technology), competency (clinical and intelligent), data (reasonable logic), and safeguards (checks and balances) (Ross et al., 2024).
- **International Council of Nurses (ICN):** The ICN has published documents addressing ethical considerations for AI in nursing, focusing on patient safety and decision-making (https://www.icn.ch/sites/default/files/2023-08/ICN%20Position%20Statement%20Digital%20Health%20FINAL%2030.06_EN.pdf).
- **National League for Nursing (NLN):** The NLN is committed to ensuring nursing education programs prepare students to use AI technologies effectively and ethically (<https://www.nln.org/>).

Competency Considerations

Building competency in AI and digital health literacy is essential for the future of nursing practice. This starts by incorporating AI literacy into nursing education, ensuring that current and future nurses are prepared to use these tools effectively. Hands-on training and real-world applications are critical for building practical experience. Continuing education programs should offer practicing nurses the opportunity to stay current with advances in AI so they can continually adapt to new technologies. Collaborative learning, where nurses work alongside technology experts and ethicists, can deepen their understanding of how AI fits within the larger healthcare ecosystem. Key competency takeaways, aligned with the N.U.R.S.E.S framework, are summarized as follows (ANA Center for Ethics and Human Rights, 2022; Glauber et al., 2023; Google, 2024; Robert, 2019):

- **Understanding of AI Concepts:** Nurses should have a basic understanding of AI concepts, including machine learning, natural language processing, and data mining. This knowledge will help them evaluate the capabilities and limitations of AI tools.
- **Data Literacy:** Nurses should consider being proficient in data interpretation and analysis. This includes understanding data sources, identifying biases, and evaluating data quality.
- **Ethical Considerations:** Nurses must be aware of the ethical implications of AI in health care, such as privacy concerns, bias in algorithms, and the potential for job displacement.
- **Critical Thinking and Problem-Solving:** AI should support human decision-making, not replace it. Nurses need to be able to evaluate AI-generated recommendations and make informed, critical judgments.
- **Collaboration and Communication:** Nurses often work with data scientists, engineers, and other healthcare professionals to develop and implement AI solutions. Effective communication and collaboration skills are essential.

Ethics In Action

Guide Ethical AI Use in Nursing by Promoting Transparency, Fairness, and Accountability

"The human spirit must prevail over technology."

Albert Einstein

AI in nursing introduces several ethical and legal risks that nurse leaders must proactively manage. A lack of transparency in AI decision-making can undermine informed consent and patient

autonomy (Park, 2024). Legal questions about accountability in adverse events and unclear intellectual property rights can complicate AI's deployment (Heidt, 2024; Labkoff et al., 2024). From patient surveillance to informed consent, ethical AI use is now part of leadership's duty of care. Clinical leaders must help shape governance structures that ensure transparency and safeguard patient autonomy. Educators must prepare students to evaluate the ethical consequences of emerging technologies. Nurse scientists and researchers must explore new ethical frontiers, like predictive policing of health behaviors or AI nudging and washing (Sumner et al., 2023), and develop nursing-specific ethical guidelines where gaps exist. Even if nursing is not directly leading the efforts, nurses' needs and workflows should be considered in ethical AI development.

Ethical Considerations

Technological limitations are another challenge. As previously discussed by Hoelscher (2025), while AI can potentially transform health care, it is not infallible. Pitfalls previously discussed, such as incomplete or biased data, can produce incorrect or nonsensical outputs. Nurses must critically evaluate AI recommendations and use their clinical judgment to make final decisions, underscoring the importance of AI literacy.

Ethical and legal considerations are central to AI literacy. Nurses must be aware of AI's ethical issues, such as the need for transparency, accountability, and sound AI governance. For example, algorithmic decisions leading to denied patient care (as with prior authorizations) due to biased data, surveillance misuse, or hallucinations have raised concerns about the ethical implications of AI use in various settings (Hoelscher, 2025). Understanding how social, economic, and political systems influence AI-based tools and the impact of these relationships on justice, equity, and ethics is helpful. This knowledge supports nurses in advocating for patients and ensuring that AI is used responsibly and ethically in health care.

Informed Consent and Patient Autonomy

For nurses learning about AI literacy, it is important to understand that a lack of transparency in AI can undermine patient autonomy, making it harder for patients to make informed, authentic choices. Transparency involves healthcare organizations informing patients about using AI in their care and decision-making processes (Park, 2024). The black-box nature of AI, where decision-making processes are not easily explained, compounds this issue (Williamson & Prybutok, 2024). Just as clinicians can become overly dependent on AI, patients might also be affected by inaccurate AI outputs or rely exclusively on what the AI application tells them (e.g., Google searches). This could reduce their ability or willingness to think independently or discuss their healthcare needs with their providers (discussed further shortly). Lack of transparency can also hinder informed consent and patient autonomy, as patients may be unable to make well-informed decisions about their care if they do not fully understand how AI influences their treatment plans (Hoelscher et al., 2024; Park, 2024; Ross et al., 2024). AI systems may impact patient autonomy by subtly influencing decision-making processes through personalized recommendations or predictive tools. For example, when a machine learning algorithm provides a diagnosis or treatment option without a clear explanation (transparency) of how it reached that conclusion, the patient is potentially excluded from the decision-making process (Guerrero Quiñones, 2025; Park, 2024). Without understanding the rationale behind the AI output, the patient and possibly clinicians cannot meaningfully question, consent to, or decline the recommendation. This could undermine their autonomy and reduce their role as active participants in their own care.

Prior Authorizations

Another example of what might be considered an unethical use of AI in health care is payor groups and prior authorization abuses with AI. Uniquely, this is not an issue with the AI itself, but how it is being used. In 2023, a federal class action lawsuit was filed against UnitedHealthcare Group, alleging that its AI system for prior authorizations, particularly the "nH Predict" algorithm, had a 90% error rate and wrongfully denied care by using rigid, financially driven decision models (Talia, 2024). The AI system reportedly overruled physicians' clinical judgments, especially for Medicare Advantage patients needing post-acute care (Wilson, 2025). With only 0.2% of policyholders appealing denials, many seeing it as futile, the lawsuit highlights growing ethical and legal concerns over AI's opaque role in healthcare decisions. The controversy intensified following the rebranding of NaviHealth, the developer of the algorithm, as Optum Home & Community Care in 2024.

Overreliance

While AI offers significant benefits, there is also a concern about dependence on technology and the potential for system failures (Anders, 2023). Relying too heavily on AI systems can lead to problems if the technology fails or produces inaccurate results. Overreliance on AI without thorough validation can lead to misdiagnoses or harm (Williamson & Prybutok, 2024). Nurses must be trained to recognize risks and have contingency plans in place to ensure patient care is not compromised by technological issues (Ahmed, 2024; Hoelscher et al., 2024). Relying too heavily on AI systems can also lead to a lack of critical thinking skills, as well, which is a high-impact issue for nursing (Ahmed, 2024; Glauber et al., 2023; Hoelscher et al., 2024). This also relates to issues in academia with students and AI, academic integrity/plagiarism issues, and copyright confusion, all matters the learning sector of nursing continues to work through.

Quach (2022) discusses the use of AI in writing lessons for students with Anna Mills, an AI literacy advocate. Mills discusses how AI use might impact critical thinking skills, specifically in the writing and revising process, something that academics are currently struggling with, "Writing is not just outputs. Writing and revising is a process that develops our thinking..." (para. 24). This issue with critical thinking and overreliance on AI can play directly into today's CDS in EHRs and other digital health technologies.

AI Detectors and Academics

AI detectors, designed to identify AI-generated content, are still highly unreliable and problematic for educational settings. Commonly available tools such as Grammarly and Turnitin have various versions of AI detectors. Turnitin recently updated their AI writing stance, posting that their detection tool is not 100% effective, and should not be considered the sole reason a student receives judgment or academic action against them (Turnitin, 2025). Even the popular OpenAI application, ChatGPT (OpenAI; San Francisco California, USA), turned its AI detector off early on because of issues with detection accuracy (Nelson, 2023). AI-detection applications often misidentify non-native English writing as AI-generative, among other circumstances. A Stanford University study found that detectors flagged up to 97% of the Test of English as a Foreign Language essays written by non-native English speakers, creating an ethical dilemma (Liang et al., 2023). This is because these systems rely heavily on a metric known as "perplexity," which measures language completeness, something non-native speakers naturally score lower on (Liang et al., 2023). The widespread application of AI detectors could disproportionately penalize international students, raising concerns about fairness and bias.

The use of GenAI in academic writing, including research manuscripts and journal submissions, raises important questions about integrity and transparency. As AI technologies become more

prevalent, the challenge of detecting AI-generated content grows, requiring journal editors and researchers to stay informed about AI developments and employ various detection strategies. These include recognizing unusual language patterns, scrutinizing references, and verifying authenticity and data accuracy (Jairoun et al., 2024). Despite the obstacles of limited time, awareness, and resources, editors can enhance detection efforts through education programs and collaboration with AI experts (Jairoun et al., 2024; Oermann, 2024). Many journals are now requiring authors to disclose their use of AI, emphasizing the importance of transparency and ethical guidelines to uphold academic rigor and trust in published research (<https://www.sciencedirect.com/journal/nursing-outlook/publish/guide-for-authors>).

Legal Compliance and Regulatory Standards

The development of AI tools involves significant innovation, which raises intellectual property concerns. Questions arise regarding the ownership of algorithms and the data used to train these systems (Heidt, 2024). Protecting intellectual property rights while fostering innovation is a delicate balance that needs to be addressed in the context of AI in health care.

As AI systems become more autonomous, assigning blame for errors becomes challenging (Labkoff et al., 2024; Olawade et al., 2024). There is a lack of clear legal frameworks to determine who is responsible, whether healthcare providers, AI developers, or the organization (Naik et al., 2022). This legal ambiguity can lead to complex liability issues (Labkoff et al., 2024). Additionally, regulatory bodies are still working on policies and recommendations on data protection to attempt to address AI's unique risks (e.g., cyberattacks and patient privacy) (Naik et al., 2022; Olawade et al., 2024). The challenge with regulation is addressing risks we may not understand or have thought of yet (Heidt, 2024).

Regarding regulation, the United States has been somewhat behind in taking the lead on AI development and advancement. The European Union (EU) started early with the development of the European AI Alliance in 2018, which later became the full EU Artificial Intelligence Act (Regulation (EU) 2024/1689, 2024). The EU AI Act establishes a comprehensive regulatory framework for AI systems, classifying them based on risk levels: unacceptable, high, limited, and minimal. It imposes strict obligations on high-risk AI systems, including transparency, accountability, and human oversight. It prohibits certain AI practices such as social scoring (classifying individuals by social behavior or traits, resulting in unfair treatment) and manipulative techniques (Regulation (EU) 2024/1689, 2024).

The World Health Organization (WHO) published its six AI design and use guiding principles in 2021. Summarized, the principles consist of the following (WHO, 2021):

- (a) Protecting human autonomy
- (b) Promoting well-being and safety
- (c) Ensuring transparency and explainability
- (d) Fostering responsibility and accountability
- (e) Ensuring inclusiveness and equity
- (f) Promoting responsiveness and sustainability

During the Biden administration, President Biden issued an Executive Order (EO) No. 14110, 88 F.R. 751941 (2023) (*Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence*) to increase the U.S. development and usage of AI, while being cognizant of the risks, including national security risk, fraud, discrimination, bias, disinformation, etc. Upon taking office in January 2025, President Trump immediately issued EO No. 14148, 90 F.R. 8237 (2025) that included the rescission of EO 14110. This did not undo all the Biden AI efforts, as the Biden AI infrastructure (EO No. 14141, 2025) and cybersecurity (EO No. 14144, 2025) remain intact. Since then,

President Trump issued another EO (EO No. 14277, 2025), *Advancing Artificial Intelligence Education for American Youth*, focusing on enhancing AI literacy to maintain U.S. technological leadership. The order establishes a White House Task Force on AI education, including key officials like the Director of the Office of Science and Technology Policy and the Secretary of Education.

Shape the Future of Nursing

Direct AI Implementation That Aligns With Nursing Values and Implements Care Equity

"If I had an hour to solve a problem and my life depended on it, I would use the first 55 minutes determining the proper questions to ask."

Albert Einstein, Nobel Laureate in Physics (1921).

Nurse leaders must be co-designers, not passengers, in AI integration. Whether through innovation councils, vendor partnerships, or informatics task forces, nurse leaders have the experiential insight to guide how AI is adopted in the clinic or at the bedside. Educators should challenge students and themselves to think like innovators, not just users. In research, nurse-led AI projects should focus on equity-oriented outcomes, addressing historically underserved communication through smart tech deployment.

Proactive involvement begins with nurses stepping into leadership roles within AI-focused projects and committees (Adegboye, 2024; Hoelscher et al., 2024; Kimiafar et al., 2023; Ross et al., 2024). By joining interdisciplinary teams, nurses can help guide the development and implementation of AI technologies, ensuring that they reflect clinical realities and the needs of both patients and healthcare providers (Adegboye, 2024). Nurses can contribute to innovation and improvement in health care by serving as valuable sources of feedback, such as serving on informatics super-user committees or participating in organizational AI policy development. Nurses on the frontlines of patient care are uniquely positioned to provide insights into AI tools' practical workflows and applications (Perchik et al., 2023; Ross et al., 2024). By sharing their experiences, nurses can help developers refine these systems to make them more intuitive, effective, and aligned with clinical workflows. Additionally, nurses can actively participate in research and development, contributing to studies exploring AI's potential in health care (Long & Magerko, 2020; Perchik et al., 2023; Ross et al., 2024).

Advocacy is another powerful tool at nurses' disposal. By actively advocating for the nursing perspective in technological advancements, nurses can ensure that AI tools support and enhance nursing practice. Nurse advocacy may also address potential concerns, such as job displacement, while highlighting the transformative potential of AI for improving patient care (Adegboye, 2024; Perchik et al., 2023).

Whether collaborating on pilot programs or leading studies on new AI applications, nurses can help ensure these technologies are designed with real-world use in mind. Looking ahead, nurses must cultivate a vision for tomorrow by anticipating how AI will transform their practice. By envisioning AI as an ally, nurses can prepare for the integration of emerging technologies like robotics and genomics (Long & Magerko, 2020).

The Need for AI Literacy in Nursing

As AI continues to permeate health care, it is no longer optional to cultivate AI literacy among nurses; it is foundational to the future of equitable, ethical, and effective care. AI literacy encompasses not only understanding and using AI tools but also crucially evaluating their output, recognizing limitations, and advocating for appropriate

integration in clinical, education, and research contexts (Al Khatib & Ndiaye, 2025; Hoelscher et al., 2024; Kimiafar et al., 2023; Ross et al., 2024). While some may argue that nurses are not central to the science or scholarship of AI, this perspective underestimates the influence of nurses who are already shaping the field. Pioneering AI nurse leaders such as Keating (2024), McGrow (2025), Ross et al. (2024), and Rossetti et al. (2025) are leading efforts to educate users as well as design, evaluate, and ethically deploy AI technologies in nursing practice and health systems research. For every nurse who questions whether they belong “at the table,” others are already seated, speaking the language of data, care, and ethics. The future of AI in health care must be built with nursing perspectives at the forefront, not as an afterthought, but as a strategic necessity. The profession must continue claiming space, building expertise, and guiding innovation that centers on patients and communities. Nurses are not just users of AI; they are essential collaborators in its evolution.

Disclaimer

The authors do not endorse any specific generative AI applications discussed within this paper.

Funding

This research received no specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CRedit Statement

Ashley Pugh: Writing- Reviewing and Editing, Resources. Stephanie H. Hoelscher: Writing- Reviewing and Editing, Writing-Original draft preparation, Visualization, Supervision, Software, Resources, Conceptualization

Declaration of Competing Interest

The authors declare no conflict of interest.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the author(s) used Open AI ChatGPT 4o and Dall-e 3 in order to provide writing clarity and in collaboration for image creation. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.outlook.2025.102466](https://doi.org/10.1016/j.outlook.2025.102466).

References

- Adegboye, M. (2024). Impact of artificial intelligence on health information literacy: Guidance for healthcare professionals. *Library Hi Tech News*, 41(7), 1–4. <https://doi.org/10.1108/LHTN-03-2024-0048>
- Ahmed, S. K. (2024). Artificial intelligence in nursing: Current trends, possibilities and pitfalls. *Journal of Medicine, Surgery, and Public Health*, 3, Article 100072. <https://doi.org/10.1016/j.jlmedi.2024.100072>
- Al Khatib, I., & Ndiaye, M. (2025). Examining the role of AI in changing the role of nurses in patient care: Systematic review. *JMIR Nursing*, 8, Article e63335. <https://doi.org/10.2196/63335>
- American Nurses Association (ANA) Center for Ethics and Human Rights. (2022). *The ethical use of artificial intelligence in nursing practice* (Position statement). http://www.nursingworld.org/~48f653/globalassets/practiceandpolicy/nursing-excellence/ana-position-statements/the-ethical-use-of-artificial-intelligence-in-nursing-practice_bod-approved-12_20_22.pdf.
- Anders, B. A. (2023). *The AI literacy imperative: Empowering instructors & students*. Sovorel Publishing.
- Cary, M. P., De Gagne, J. C., Kauschinger, E. D., & Carter, B. M. (2024). Advancing health equity through artificial intelligence: An educational framework for preparing nurses in clinical practice and research. *Creative Nursing*, 30(2), 154–164. <https://doi.org/10.1177/10784535241249193>
- Castonguay, A., Farthing, P., Davies, S., Vogelsang, L., Kleib, M., Risling, T., & Green, N. (2023). Revolutionizing nursing education through AI integration: A reflection on the disruptive impact of ChatGPT. *Nurse Education Today*, 129, 105916. <https://doi.org/10.1016/j.nedt.2023.105916>
- Exec. Order No. 14110, 88 F.R. 751941 (2023). <https://www.federalregister.gov/documents/2023/11/01/2023-24283/safe-secure-and-trustworthy-development-and-use-of-artificial-intelligence>.
- Exec. Order No. 14141, 90 F.R. 5469 (2025). <https://www.federalregister.gov/documents/2025/01/17/2025-01395/advancing-united-states-leadership-in-artificial-intelligence-infrastructure>.
- Exec. Order No. 14144, 90 F.R. 6755 (2025). <https://www.federalregister.gov/documents/2025/01/17/2025-01470/strengthening-and-promoting-innovation-in-the-nations-cybersecurity>.
- Exec. Order No. 14148, 90 F.R. 8237 (2025). <https://www.federalregister.gov/documents/2025/01/28/2025-01901/initial-rescissions-of-harmful-executive-orders-and-actions>.
- Exec. Order No. 14277, 90 F.R. 17519 (2025). <https://www.federalregister.gov/documents/2025/04/28/2025-07368/advancing-artificial-intelligence-education-for-american-youth>.
- Fiore K. (2024). *The language of AI: Defining the most common terms*. MedPage Today. <https://www.medpagetoday.com/special-reports/features/108692>.
- Gandhi, T. K., Classen, D., Sinsky, C. A., Rhew, D. C., Vande Garde, N., Roberts, A., & Federico, F. (2023). How can artificial intelligence decrease cognitive and work burden for front-line practitioners? *JAMA Open*, 6(3), Article ooad079. <https://doi.org/10.1093/jamiaopen/ooad079>
- Glauber, G., Ito-Fujita, A., Katz, S., & Callahan, J. (2023). Artificial intelligence in nursing education: Opportunities and challenges. *Hawai'i Journal of Health & Social Welfare*, 82(12), 302–305.
- Google. (2024). *Gemini 1.5 Flash* (Large language model). <https://gemini.google.com/>.
- Guerrero Quiñones, J. L. (2025). Using artificial intelligence to enhance patient autonomy in healthcare decision-making. *AI & Society*, 40, 1917–1926. <https://doi.org/10.1007/s00146-024-01956-6>
- Heidt, A. (2024). Intellectual property and data privacy: The hidden risks of AI. *Nature*. <https://doi.org/10.1038/d41586-024-02838-z>
- Hobensack, M., von Gerich, H., Vyas, P., Withall, J., Peltonen, L. M., Block, L. J., Davies, S., Chan, R., Van Bulck, L., Cho, H., Paquin, R., Mitchell, J., Topaz, M., & Song, J. (2024). A rapid review on current and potential uses of large language models in nursing. *International Journal of Nursing Studies*, 154, Article 104753. <https://doi.org/10.1016/j.ijnurstu.2024.104753>
- Hoelscher, S. H. (2025). The good, the bad, and the binary: Ethical impact of AI on nursing practice. *Nursing*, 55(4), 26–32. <https://doi.org/10.1097/NSG.0000000000000160>
- Hoelscher, S. H., Taylor-Pearson, K., & Wei, H. (2024). Charting the path: Nursing leadership in artificial intelligence integration into healthcare. *Nurse Leader*, 22(6), 763–772. <https://doi.org/10.1016/j.mnl.2024.07.011>
- IBM. (2024). *Upskilling and the reskilling for talent transformation in the era of AI*. <https://www.ibm.com/think/insights/ai-upskilling>.
- Keating, R. (2024). Amy McCarthy DNP, RNC-MNN, NE-BC, CENP joins Hippocratic AI as its Chief Nursing Officer. *Business Wire*. <https://www.businesswire.com/news/home/20240807130128/en/Amy-McCarthy-DNP-RNC-MNN-NE-BC-CENP-joins-Hippocratic-AI-as-its-Chief-Nursing-Officer>.
- Kimiafar, K., Masoumen, S., Tabatabaei, S. M., Ghaddarpouri, K., Mousavi, A. S., Mehneh, M. R., & Baigi, S. F. M. (2023). Artificial intelligence literacy among healthcare professionals and students: A systematic review. *Frontiers in Health Informatics*, 12, 168. <https://doi.org/10.3389/fhi.v12i0.524>
- Jairoun, A. A., El-Dahiyat, F., ElRefae, G. A., Al-Hemyari, S. S., Shahan, M., Zyoud, S. H., Hammour, K. A., & Babar, Z. U. (2024). Detecting manuscripts written by generative AI and AI-assisted technologies in the field of pharmacy practice. *Journal of Pharmaceutical Policy and Practice*, 17(1), Article 2303759. <https://doi.org/10.1080/20523211.2024.2303759>
- Labkoff, S., Oladimeji, B., Kannry, J., Solomonides, A., Leftwich, R., Koski, E., ... Quintana, Y. (2024). Toward a responsible future: Recommendations for AI-enabled clinical decision support. *Journal of the American Medical Informatics Association: JAMIA*, 31(11), 2730–2739. <https://doi.org/10.1093/jamia/ocae209>
- Lawry, T. (2021). Applied artificial intelligence and machine learning: The impact on the health informatics workforce. In J. Kleindienst (Ed.). *The handbook of continuing professional development for the health informatics professional* (2nd ed.). Routledge Taylor & Francis Group <https://doi.org/10.4324/9780429398377-40>
- Liang, W., Yuksekgonul, M., Mao, Y., Wu, E., & Zou, J. (2023). GPT detectors are biased against non-native English writers. *arXiv*, 2304, 02819. <https://doi.org/10.48550/arXiv.2304.02819>
- Long, D., & Magerko, B. (2020). *What is AI literacy? Competencies and design considerations. Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. New York, NY United States: Association for Computing Machinery 1–16. <https://doi.org/10.1145/3313831.3376727>
- McGrow, K. (2025). Artificial intelligence in nursing: A journey from data to wisdom. *Nursing*, 55(4), 16–24. <https://doi.org/10.1097/NSG.0000000000000165>
- Naik, N., Hameed, B. M. Z., Shetty, D. K., Swain, D., Shah, M., Paul, R., Aggarwal, K., Ibrahim, S., Patil, V., Smriti, K., Shetty, S., Rai, B. P., Chlosta, P., & Somani, B. K. (2022). Legal and ethical consideration in artificial intelligence in healthcare:

- Who takes responsibility? *Frontiers in Surgery*, 9, Article 862322. <https://doi.org/10.3389/fsurg.2022.862322>
- Narayanan, S., Ramakrishnan, R., Durairaj, E., & Das, A. (2023). Artificial intelligence revolutionizing the field of medical education. *Cureus*, 15(11), Article e49604. <https://doi.org/10.7759/cureus.49604>
- Nazer, L. H., Zatarah, R., Waldrip, S., Ke, J. X. C., Moukheiber, M., Khanna, A. K., et al. (2023). Bias in artificial intelligence algorithms and recommendations for mitigation. *PLOS Digit Health*, 2(6), Article e0000278. <https://doi.org/10.1371/journal.pdig.0000278>
- Nelson, J. (2023, July 24). *OpenAI quietly shuts down its AI detection tool*. Decrypt. <https://decrypt.co/149826/openai-quietly-shuts-down-its-ai-detection-tool>
- Nutbeam, D. (2023). Artificial intelligence and health literacy—proceed with caution. *Health Literacy and Communication Open*, 1(1), <https://doi.org/10.1080/28355245.2023.2263355>
- Obermeyer, Z., Powers, B., Vogeli, C., & Mullainathan, S. (2019). Dissecting racial bias in an algorithm used to manage the health of populations. *Science (New York, N. Y.)*, 366(6464), 447–453. <https://doi.org/10.1126/science.aax2342>
- Oermann, M. H. (2024). Using AI to write scholarly articles in nursing. *Nurse Educator*, 49(1), 52. <https://doi.org/10.1097/NNE.0000000000001577>
- Olawade, D. B., David-Olawade, A. C., Wada, O. Z., Asaolu, A. J., Adereni, T., & Ling, J. (2024). Artificial intelligence in healthcare delivery Prospects and pitfalls. *Journal of Medicine, Surgery, and Public Health*, 3, Article 100108. <https://doi.org/10.1016/j.gmedi.2024.100108>
- OpenAI. (2024). *ChatGPT 4o* (Large language model). <https://openai.com/index/chatgpt/>
- Owens, L. M., Wilda, J. J., Hahn, P. Y., Koehler, T., & Fletcher, J. J. (2024). The association between use of ambient voice technology documentation during primary care patient encounters, documentation burden, and provider burnout. *Family Practice*, 41(2), 86–91. <https://doi.org/10.1093/fampra/cmadv092>
- Park, H. J. (2024). Patient perspectives on informed consent for medical AI: A web-based experiment. *Digital Health*, 10. <https://doi.org/10.1177/20552076241247938>
- Perchik, J. D., Smith, A. D., Elkassem, A. A., Park, J. M., Rothenberg, S. A., Tanwar, M., ... Sotoudeh, H. (2023). Artificial intelligence literacy: Developing a multi-institutional infrastructure for AI education. *Academic Radiology*, 30, 1472–1480. <https://doi.org/10.1016/j.acra.2022.10.002>
- Quach, K. (2022). *University students recruit AI to write essays for them. Now what? The Register*. https://www.theregister.com/2022/12/27/university_ai_essays_students/
- Regulation (EU) 2024/1689. (2024). Regulation (EU) 2024/1689 of the European Parliament and of the Council on the artificial intelligence systems and imposing certain bans on hazardous AI practices, and amending certain Union legislative acts. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202401689
- Robert, N. (2019). How artificial intelligence is changing nursing. *Nursing Management*, 50(9), 30–39. <https://doi.org/10.1097/01.NUMA.0000578988.56622.21>
- Ross, A., Freeman, R., McGrow, K., & Kagan, O. (2024). Implications of artificial intelligence for nurse managers. *Nursing Management*, 55(7), <https://doi.org/10.1097/nmg.0000000000000143>
- Rossetti, S. C., Dykes, P. C., Knaplund, C., Cho, S., Withall, J., Lowenthal, G., Albers, D., Lee, R. Y., Jia, H., Bakken, S., Kang, M. J., Chang, F. Y., Zhou, L., Bates, D. W., Daramola, T., Liu, F., Schwartz-Dillard, J., Tran, M., Bokhari, S. M. A., Thate, J., ... Cato, K. D. (2025). Real-time surveillance system for patient deterioration: a pragmatic cluster-randomized controlled trial. *Nature Medicine*. <https://doi.org/10.1038/s41591-025-03609-7>
- Seneor, A., & Mezzanotte, M. (2022). *Open-source data science: How to reduce bias in AI*. World Economic Forum. <https://www.weforum.org/agenda/2022/10/open-source-data-science-bias-more-ethical-ai-technology/>
- Shaw, R. J. (2023). Access to technology and digital literacy as determinants of health and health care. *Creative Nursing*, 29(3), 258–263. <https://doi.org/10.1177/10784535231211682>
- Sui, P., Duede, E., Wu, S., & So, R. J. (2024). Confabulation: The surprising value of large language model hallucinations. *Proceedings of the 62nd Annual Meeting of the Association for Computational Linguistics*, 1, 14274–14284. <https://doi.org/10.18653/v1/2024.acl-long.770>
- Sumner, J., Bunde, A., Lim, H. W., Phan, P., Motani, M., & Mukhopadhyay, A. (2023). Developing an artificial intelligence-driven nudge intervention to improve medication adherence: a human-centered design approach. *Journal of Medical Systems*, 48(1), 3. <https://doi.org/10.1007/s10916-023-02024-0>
- Talia, D. (2024). Algorithms that can deny care, and a call for AI explainability. *Computer*, 57(7), 109–112. <https://doi.org/10.1109/MC.2024.3387012>
- Turnitin. (2025). *AI writing detection in the classic report view*. <https://guides.turnitin.com/hc/en-us/articles/28457596598925-AI-writing-detection-in-the-classic-report-view>
- Williamson, S. M., & Prybutok, V. (2024). The era of artificial intelligence deception: Unraveling the complexities of false realities and emerging threats of misinformation. *Information*, 15(6), 299. <https://doi.org/10.3390/info15060299>
- Wilson, R. (2025). *UnitedHealthcare to cut prior authorization by 10%. Becker's Payer Issues*. <https://www.beckerspayers.com/policy-updates/unitedhealth-to-cut-prior-authorization-by-10/>
- World Health Organization. (2021). *WHO issues first global report on artificial intelligence (AI) in health and six guiding principles for its design and use*. <https://www.who.int/news/item/28-06-2021-who-issues-first-global-report-on-ai-in-health-and-six-guiding-principles-for-its-design-and-use>
- Yelne, S., Chaudhary, M., Dod, K., Sayyad, A., & Sharma, R. (2023). Harnessing the power of AI: A comprehensive review of its impact and challenges in nursing science and healthcare. *Cureus*, 15(11), Article e49252. <https://doi.org/10.7759/cureus.49252>
- Sullivan, D., Hall, V. P., & Morrison, J. (2024). Navigating the future: Artificial intelligence's impact on transformational nurse leadership. *Teaching and Learning in Nursing*, 3(19), 298–300. <https://doi.org/10.1016/j.teln.2024.04.017>