

Artificial Intelligence in Nursing Care: A Systematic Literature Review and Bibliometric Analysis

Inteligencia Artificial en la Atención de Enfermería: Una Revisión Sistemática de la Literatura y Análisis Bibliométrico

Heri Nur Cahyanto^{1a}, Ariska Putri Hidayathillah^{2a}, Denis Farida^{3a}, Alpian Jayadi^{4a}, Wahyuni Tri Lestari^{5b*}, Putri Pamungkas^{6a}

SUMMARY

Introduction: Numerous studies have investigated the application of Artificial Intelligence (AI) in healthcare. However, research specifically focusing on AI in nursing care remains relatively limited. This study addresses this gap by examining the development, distribution, and challenges of AI applications in nursing through a systematic literature review and bibliometric analysis.

Methods: This study employed a systematic literature review combined with a bibliometric approach. A search in the Scopus database using combined

synonyms and related terms with Boolean operators and truncations: (“artificial intelligence” OR “AI” OR “machine learning” OR “deep learning” OR “neural network*”) AND (“nursing care” OR “nursing practice” OR “clinical decision support” OR “nursing education” OR “patient care”) yielded publications up to September 9, 2025. After screening and applying the inclusion criteria, 60 eligible articles were included in the analysis. Bibliometric mapping with VOSviewer was used to identify research trends, publication patterns, collaborations, and key themes. **Results:** The findings indicate that AI research in nursing care is predominantly concentrated in developed countries, with limited contributions from developing regions. The main research themes include Clinical Decision Support Systems (CDSS), patient risk prediction, AI-based nursing education, and electronic documentation. Key challenges identified include ethical issues, digital literacy gaps, and trust between nurses and patients, all of which warrant further exploration in future studies.

Conclusion: This study highlights the evolving role of AI in nursing care, emphasizing its potential to enhance clinical decision-making, improve patient safety, and support digital transformation. At the same time, it underscores the need for broader research coverage, particularly in developing countries, and greater attention to ethical and social dimensions to ensure equitable and responsible AI integration in nursing practice.

Keywords: Artificial intelligence, nursing care, systematic literature review, bibliometric analysis, VOSviewer.

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ORCID: 0009-0007-1343-4077¹
ORCID: 0009-0000-6671-2156²
ORCID: 0009-0000-5633-776X³
ORCID: 0009-0006-5303-5559⁴
ORCID: 0000-0002-2839-9231⁵
ORCID: 0009-0009-8022-0145⁶

^aNursing Study Program, Institute of Health and Business Surabaya.

^bDepartment of Fundamental Nursing, Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia

*Corresponding Author: Wahyuni Tri Lestari
E-mail: wahyuni.tri.lestari@fkip.unair.ac.id

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RESUMEN

Introducción: *Numerosos estudios han investigado la aplicación de la Inteligencia Artificial (IA) en la atención sanitaria. Sin embargo, la investigación centrada específicamente en la IA en la atención de enfermería sigue siendo relativamente limitada. Este estudio aborda esta deficiencia mediante una revisión sistemática de la literatura y un análisis bibliométrico, que examinan el desarrollo, la distribución y los desafíos de las aplicaciones de la IA en enfermería.*

Métodos: *Este estudio empleó una revisión sistemática de la literatura combinada con un enfoque bibliométrico. Se realizó una búsqueda en la base de datos Scopus utilizando sinónimos y términos relacionados combinados con operadores booleanos y truncamientos: (“artificial intelligence” OR “AI” OR “machine learning” OR “deep learning” OR “neural network*”) AND (“nursing care” OR “nursing practice” OR “clinical decision support” OR “nursing education” OR “patient care”), abarcando publicaciones hasta el 9 de septiembre de 2025. Tras la selección y aplicación de los criterios de inclusión, se analizaron 60 artículos elegibles. Se utilizó el mapeo bibliométrico con VOSviewer para identificar tendencias de investigación, patrones de publicación, colaboraciones y temas clave.*

Resultados: *Los hallazgos indican que la investigación en IA aplicada a la atención de enfermería se concentra predominantemente en los países desarrollados, con contribuciones limitadas de las regiones en desarrollo. Los principales temas de investigación incluyen los Sistemas de Apoyo a la Decisión Clínica (SADC), la predicción del riesgo del paciente, la formación en enfermería basada en IA y la documentación electrónica. Los principales desafíos identificados incluyen cuestiones éticas, brechas en la alfabetización digital y la falta de confianza entre enfermeras y pacientes, que requieren mayor exploración en futuros estudios.*

Conclusión: *Este estudio destaca el papel evolutivo de la IA en la atención de enfermería, destacando su potencial para mejorar la toma de decisiones clínicas, la seguridad del paciente y el apoyo a la transformación digital. Al mismo tiempo, subraya la necesidad de una mayor cobertura de la investigación, especialmente en países en desarrollo, y de una mayor atención a las dimensiones éticas y sociales para garantizar una integración equitativa y responsable de la IA en la práctica enfermera.*

Palabras clave: *Inteligencia artificial, atención de enfermería, revisión sistemática de la literatura, análisis bibliométrico, VOSviewer.*

INTRODUCTION

Artificial Intelligence (AI) in nursing has gained increasing attention for its potential to improve healthcare quality by addressing challenges such as heavy workloads, limited resources, and patient safety demands (1,2). By leveraging technologies such as generative AI, machine learning, natural language processing (NLP), and predictive analytics, it enhances patient management, streamlines documentation, and improves clinical decision-making (3,4).

Various AI implementation models in nursing demonstrate high adaptability across global contexts. This includes the development of clinical decision support systems (CDSS), companion robots, and real-time, data-driven monitoring systems, all of which highlight the potential of AI to enhance efficiency and safety across diverse nursing settings (5,6). The relevance of AI research in nursing has become increasingly evident worldwide, as reflected in the growing literature across multiple regions, including Asia (4,7), Europe (8), North America (9), and Oceania (10). However, contributions from Indonesia and other underrepresented regions remain scarce, underscoring the need for this review to broaden perspectives and address the specific challenges of healthcare system development.

Conducting a Systematic Literature Review (SLR) and bibliometric analysis of AI in nursing is particularly crucial at this stage, given the rapid development of AI technologies and their growing relevance in healthcare. Publications on AI in nursing have increased significantly, reflecting both strong academic interest and the potential for transformation in clinical and managerial nursing practices (8,11). AI technologies, including machine learning, NLP, and generative AI such as ChatGPT, are increasingly used to support decision-making, improve work efficiency, and reduce nurses' workloads, ultimately enhancing the quality of patient care (1,3,12).

An SLR provides a systematic synthesis of these developments. At the same time, bibliometric analysis enables the identification of research hotspots, gaps, and future directions, including ethical and regulatory considerations, as well as context-specific applications such

as chronic disease management and gender perspectives (7,13). Furthermore, bibliometric analysis underscores the importance of global collaboration and institutional networks in advancing AI research in nursing (14). These reviews also highlight the growing role of AI in nursing education, where AI-driven simulations, machine learning, and large language models are being utilized to enhance learning outcomes and prepare nurses for increasingly digital healthcare environments (5).

Nevertheless, the use of AI in nursing differs fundamentally from traditional practice. First, AI emphasizes efficiency, prediction, and data-driven decision-making, features not fully present in conventional models (2). Second, its application is shaped by both intrinsic factors, such as nurses' digital literacy, and extrinsic factors, including hospital policies and healthcare regulations. These factors determine how effectively AI can be implemented in nursing practice, influencing not only the technical integration of the technology but also its acceptance, usability, and alignment with existing care standards (4). Third, AI demonstrates adaptability to cultural, social, and technological contexts, an aspect often overlooked in conventional nursing practice (6).

Despite these advances, comprehensive studies that systematically explore the evolution of research, the distribution of research, and the theoretical and practical implications of AI in nursing remain limited. While several studies have reviewed AI applications in nursing education, patient management, and decision support systems, few have combined SLR and bibliometric analysis. Previous reviews often lack a longitudinal perspective, offer limited discussion of ethical and regulatory issues, and fail to integrate cross-regional comparisons adequately. Addressing these gaps through a combined approach is essential for a deeper understanding of the structure, trends, and impact of AI on nursing practice (7,8).

This study aims to address this gap by combining a Systematic Literature Review with a bibliometric analysis of the Scopus database through September 9, 2025. This approach enables comprehensive mapping of AI research development in nursing and provides deeper insights into future growth trajectories and research agendas. By combining SLR and

bibliometric analysis, this study offers not only an academic synthesis but also a practical foundation for optimizing AI integration, informing policy development, advancing nursing education, and strengthening international collaboration. This effort is expected to ensure that the implementation of AI in nursing is ethical, evidence-based, and beneficial to both nurses and patients (15).

METHODS

This study employs a systematic literature review combined with a bibliometric approach. The bibliometric method enables quantitative assessment of the literature, allowing identification of research trends, patterns, and key contributors within the field under investigation. To ensure traceability and methodological consistency, the review process adheres to the PRISMA framework, thereby facilitating a comprehensive and replicable examination of the literature. This approach provides a clear and transparent overview of the research topic, ensuring both rigor and reliability in the synthesis of findings (16). The inclusion criteria for this study were defined as follows: 1) peer-reviewed journal articles published between 1983 and September 9, 2025; 2) publications written in English, and 3) studies that specifically addressed the topic of Artificial Intelligence in nursing care.

The exclusion criteria included publications that did not meet the above requirements, such as book chapters, conference proceedings, review articles, systematic reviews, editorials, notes, dissertations, and non-English publications. Only original research articles were retained for analysis to ensure methodological rigor and relevance to the research objectives.

The bibliometric analysis was conducted using VOSviewer, a software tool for visualizing bibliographic data. Through this tool, citation networks, author collaborations, and keyword co-occurrences were mapped, providing deeper insights into the intellectual structure and the evolving dynamics of research in this field (17).

Based on the search conducted on September 9, 2025, through the Scopus database, relevant documents were identified using a comprehensive search string applied to article titles, abstracts,

and keywords. To ensure inclusivity, the search combined synonyms and related terms with Boolean operators and truncations: (“artificial intelligence” OR “AI” OR “machine learning” OR “deep learning” OR “neural network*”) AND (“nursing care” OR “nursing practice” OR “clinical decision support” OR “nursing education” OR “patient care”), This strategy was designed to capture a broader range of studies addressing the application of AI in nursing, including both clinical and educational contexts (Figure 1). The screening process excluded book chapters, reviews, conference proceedings, editorials, notes, and non-English articles. Review articles were intentionally excluded to avoid duplication of synthesized findings, as this study aimed to analyze only original research that contributes new empirical data. Nevertheless,

insights from existing reviews were considered in the discussion to provide a broader contextual understanding of the field’s development. Finally, 60 eligible articles were retained and further analyzed to address the study’s research questions. The included studies encompassed a range of research designs, quantitative, qualitative, and mixed methods, reflecting diverse methodological approaches to AI in nursing. The study populations included nurses, nursing students, and patients receiving nursing care, while the research contexts spanned clinical, community, and educational settings. This diversity enabled a comprehensive understanding of how AI is being applied and studied across different dimensions of nursing practice.

RESULTS

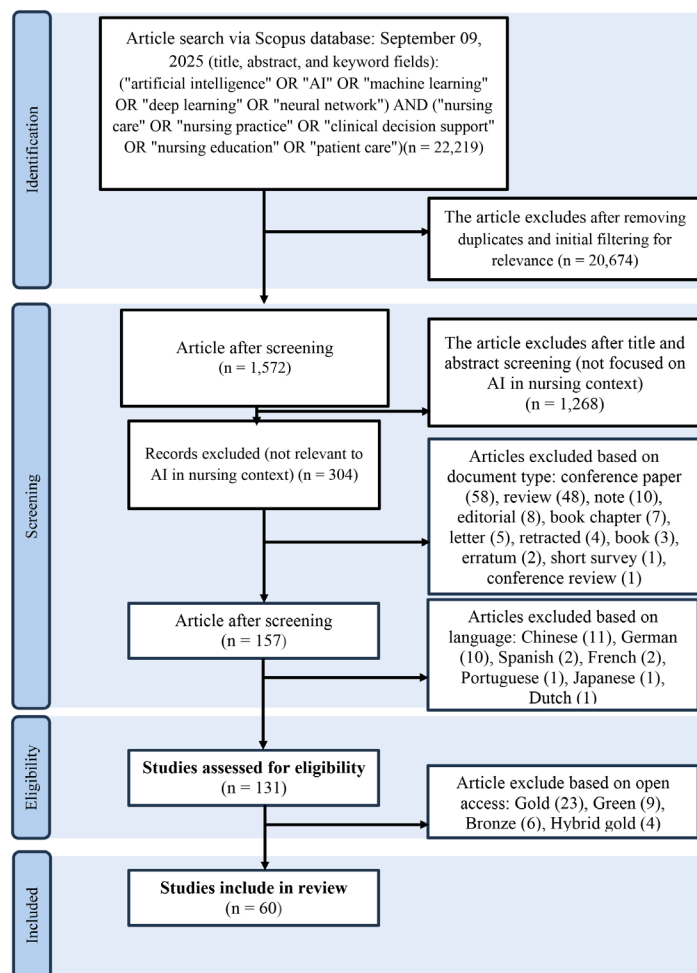


Figure 1. PRISMA flow diagram of study selection process.

Figure 1 presents the distribution of the included studies on Artificial Intelligence in nursing care, categorized by publication year, country of origin, study design, and journal source. A total of 60 eligible articles were identified after applying the inclusion and exclusion criteria. The trend shows that publications began to emerge in the early 1980s, with only one article in 1983. Research activity remained minimal and sporadic until 2010, with fewer than three articles per year. Starting in 2020, the number of publications increased significantly, peaking in 2025 with more than 20 articles, indicating a growing academic interest and technological advancement in AI applications within nursing care.

Geographically, most studies originated from the United States, the United Kingdom, and China, reflecting countries with higher

investments in digital health technologies. However, contributions from emerging regions, such as Southeast Asia, have also begun to appear in recent years, suggesting a global expansion of research on the topic.

In terms of study design, most articles employed quantitative, experimental approaches, whereas qualitative explorations were limited. This finding highlights a predominant focus on the performance evaluation of AI tools rather than on an in-depth understanding of nurses' experiences in adopting such technologies. Most studies were published in Scopus-indexed journals in nursing and health informatics, demonstrating the field's interdisciplinary nature. High-impact journals frequently cited in the dataset include *Journal of Nursing Scholarship*, *BMC Nursing*, and *International Journal of Medical Informatics*.

Distribution of Publications by Year

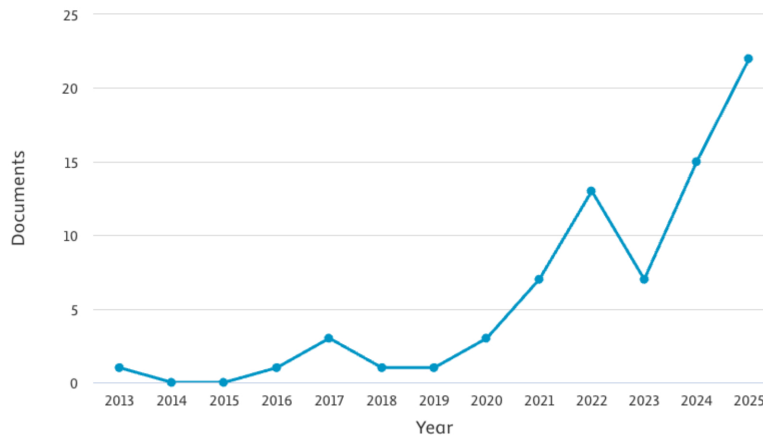


Figure 2. Distribution of publications by year (Source: Scopus database).

Based on data from the Scopus database, only 60 scholarly works on Artificial Intelligence (AI) in nursing care were identified. Figure 2 indicates that between 2013 and 2019, the number of publications remained relatively low, fluctuating between 0 and 3 per year. Beginning in 2020, a consistent increase became evident, consistent with advances in digital technologies and growing attention to healthcare efficiency.

The peak of growth occurred in 2025, when the number of publications exceeded 20. Although research on AI in nursing remained limited in earlier periods, academic interest in this topic has risen sharply over the past five years. This trend reflects the growing recognition of AI's relevance and potential to support nursing practice across diverse contexts.

Distribution of Publications by Country

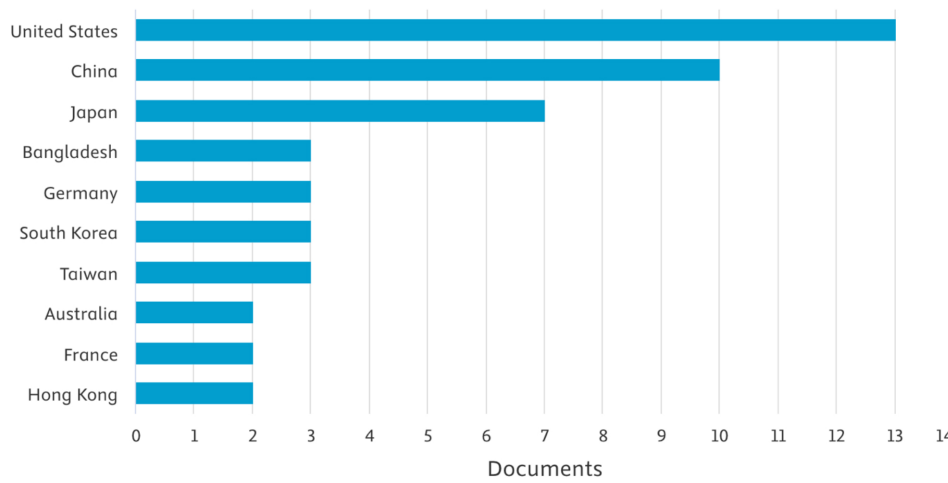


Figure 3. Distribution of publications by country/territory (Source: Scopus database).

Publications on AI in nursing care are predominantly concentrated in developed countries. The United States, United Kingdom, China, and Germany account for the largest share of contributions, while publications from developing countries such as Jordan, Saudi Arabia, and Colombia remain limited (Figure 3).

Research Focus and Hotspots

The analysis of keywords and co-occurrence mapping identified several main research hotspots (Table 1):

1. **Clinical Decision Support Systems (CDSS):** widely applied to assist nurses in diagnostic reasoning and treatment planning.
2. **Patient Risk Prediction:** AI models are increasingly used for early detection of complications and mortality risk.
3. **AI-based Nursing Education:** including simulation systems and integration of machine learning to support student training.

4. **Electronic Documentation and Workflow Efficiency:** AI supports automated charting and reduces nurses' documentation burden.
5. **Ethical and Social Challenges:** digital literacy gaps, data privacy, and nurse-patient trust remain key barriers to implementation.

Subject Area Distribution

The analysis of 60 articles on Artificial Intelligence in nursing care reveals a diverse distribution across multiple scientific domains (Figure 4). The largest proportions are in medicine (26.3 %) and nursing (22.2 %), reflecting the strong linkage between AI, clinical practice, and patient care. Computer science (11.1 %) also contributes significantly, especially in the development of algorithms and clinical decision support systems.

Other fields, such as engineering (7.1 %) and health professions (7.1 %), have provided valuable input, particularly for the design of monitoring systems and the integration of

Table 1
Article Research Focus

Country	Number of Articles	Research Focus
United States of America	13	Generative AI, clinical and administrative efficiency, AI integration in healthcare systems
China	10	Clinical prediction, big data analysis, and AI applications in patient monitoring
Japan	7	AI integration in nursing care, digital health systems
Bangladesh	3	AI implementation in critical care and public health monitoring
Germany	3	Clinical decision support systems, wound management, nursing Documentation
South Korea	3	AI for patient monitoring, electronic health records
Taiwan	3	Patient prediction models, hospital-based AI systems
Australia	2	Nursing education, AI-based learning simulations
France	2	AI for patient data analysis and elderly care
Hong Kong	2	AI chatbots in patient services and health education
Thailand	1	Early implementation of AI in clinical nursing
Colombia	1	Experimental studies on AI use in healthcare services
Belgian	1	Patient data analysis using AI
Singapore	1	AI in hospital management
Denmark	1	AI-based precision nursing
Pakistan	1	Utilization of AI to support primary care
Jordan	1	AI in community nursing practice
Norwegian	1	AI-based clinical decision support
Finland	1	Big data and AI in nursing
Saudi Arab	1	AI for chronic patient care
Indonesia	1	Preliminary studies on AI utilization in nursing
Swiss	1	AI in elderly healthcare services
Portugal	1	AI for nursing care documentation
Total	60	

smart technologies. Mathematics (5.1 %) plays an important role in predictive modelling, while biochemistry, genetics, and molecular biology (4.0 %) contribute to AI applications in biomolecular research. Contributions are also noted in social sciences (4.0 %), focusing on nurses' perceptions and adoption of AI, and in multidisciplinary studies (3.0 %) that integrate cross-disciplinary approaches. Smaller shares come from decision sciences (2.0 %) and other domains (8.1 %), including business, humanities, physics, astronomy, neuroscience, psychology, and immunology. This distribution underscores the interdisciplinary nature of AI in nursing, with the strongest contributions arising from health sciences and computer science, while also benefiting from complementary insights across diverse fields.

Source Distribution

An analysis of publications indicates that articles on Artificial Intelligence in nursing care have appeared in several internationally reputable journals (Figure 5). The *Journal of Nursing Management* was the leading source, publishing five articles during the period 2021–2025. This underscores the relevance of AI to managerial issues in nursing, particularly in terms of efficiency, leadership, and decision-making.

In addition, *BMC Nursing* published two articles in the past two years (2024 - 2025) that emphasize the practical implementation of AI in clinical practice and nursing education. *BMJ Open*, *Heliyon*, and *Contrast Media and Molecular Imaging* each contributed one article, with diverse focuses ranging from instrument

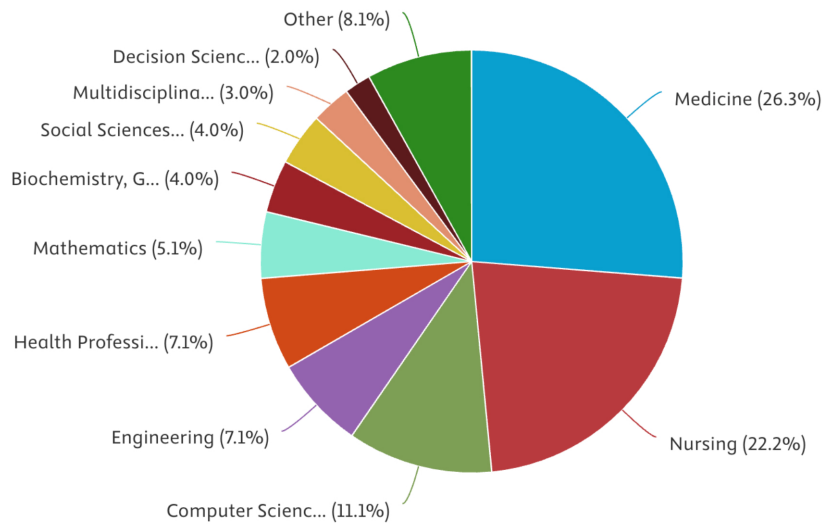


Figure 4. Distribution of articles by Subject Area (Source: Scopus database).

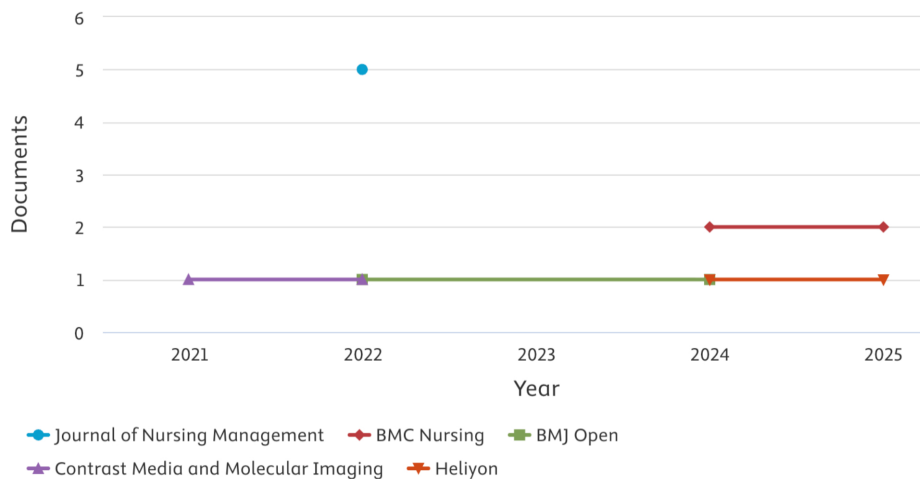


Figure 5. Number of Articles by Sources (Top 10 Sources, Source: Scopus Database).

validation and clinical applications to the integration of technology into healthcare delivery. This distribution indicates that the topic of AI in nursing is not limited to nursing journals but is also disseminated across multidisciplinary outlets. It underscores the significance of AI in healthcare across managerial, clinical, and technological dimensions.

Author Contributions

The author’s distribution of research on Artificial Intelligence in nursing care shows no clear dominance by a single individual (Figure 6). Among the top ten authors, nine of them, Aleithe M, Brehmer A, Fischer U, Hosters B, Kleesiek J, Majjouti K, Parvin MR, Pinnekamp

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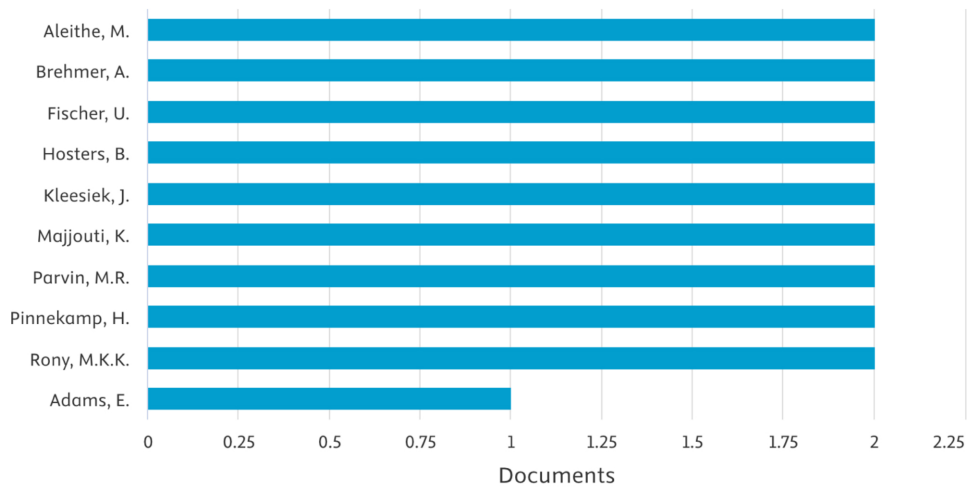


Figure 6. Distribution of articles by author (Source: Scopus database).

H, and Rony MKK, each contributed two articles. Meanwhile, only one author, Adams E, was recorded as having published one article on this topic. This distribution indicates that research on AI in nursing care remains collaborative and distributed among multiple authors, with no single researcher demonstrating clear dominance. This

stands in contrast to more established research fields, which typically have core author groups that are highly productive. It also suggests that this research area is still relatively new and continues to evolve through contributions from scholars with diverse academic backgrounds.

Country Collaboration

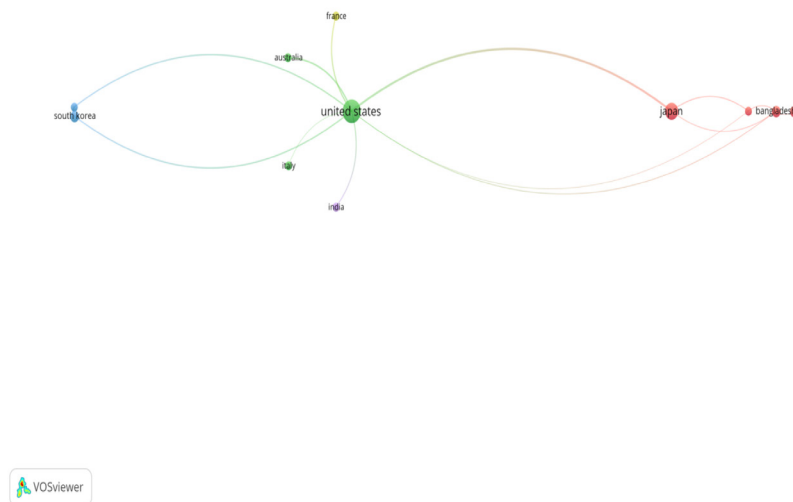


Figure 7. Country Collaboration Network in AI and nursing care research (Source: VOSviewer).

The visualization in Figure 7 illustrates the international collaboration network of countries involved in research on Artificial Intelligence in nursing care, as mapped using VOSviewer. The United States appears as the central node with the most collaborative links, indicating its dominant role in leading and connecting global research efforts. Strong collaborative ties are visible between the United States and countries such as Japan, South Korea, Australia, France, Italy, and India, reflecting a broad research network across North America, Asia, and Europe.

Japan also emerges as a significant node, closely linked to the United States and extending its collaborations to Bangladesh, highlighting growing regional research activities in Asia. Meanwhile, South Korea maintains strong bilateral ties with the United States, though these are less extensive than those with Japan. European countries such as France and Italy, as well as Australia, are integrated into the network primarily through collaborations with the United States.

Keyword Mapping

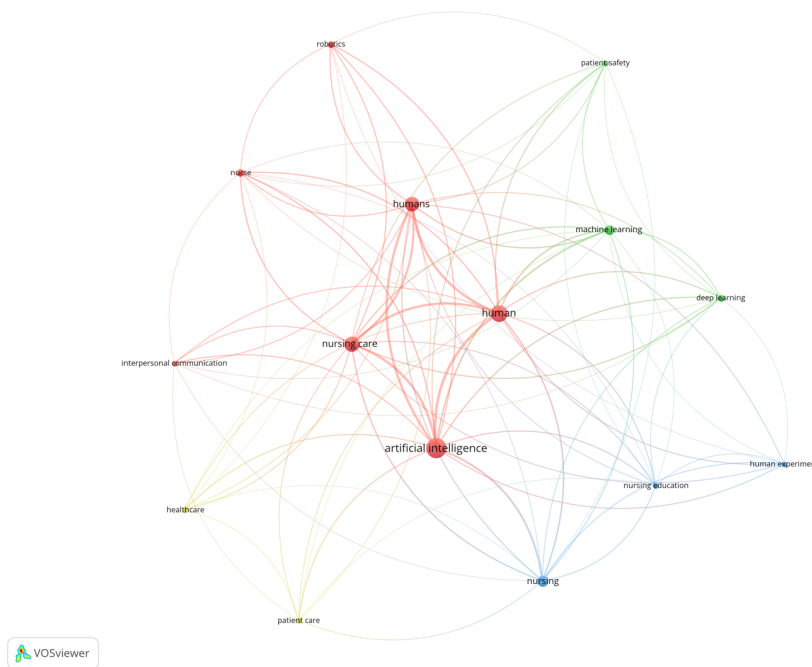


Figure 8. Keyword Co-Occurrence Mapping of AI In Nursing Care Research (Source: VOSviewer).

The co-occurrence network of keywords illustrates the main research themes in Artificial Intelligence (AI) and nursing care (Figure 8 and Table 2). The largest cluster, shown in red, is centered around keywords such as *artificial intelligence*, *nursing care*, *human*, and *humans*.

This reflects the dominance of studies focusing on the intersection of AI applications and direct nursing practice, emphasizing patient interaction, documentation, and AI’s role in supporting human-centered care. The green cluster highlights technological aspects, including *machine*

learning, deep learning, and patient safety. This suggests that research is increasingly focused on predictive modeling and risk assessment to enhance clinical outcomes and reduce adverse events. The blue cluster relates to *nursing, nursing education, and human experimentation*, indicating the growing use of AI in educational contexts, including simulation-based learning and

experimental applications to improve training and workforce readiness. Meanwhile, the yellow cluster includes *healthcare, patient care, and interpersonal communication*, underscoring the broader role of AI in healthcare delivery systems and its implications for communication between nurses and patients.

Table 2
Keyword Occurrences and Total Link Strength (TLS)

Keyword	Occurrences	Total Link Strength (TLS)
Artificial intelligence	56	268
Human	38	253
Nursing care	33	209
Article	28	206
Humans	30	196
Nursing	18	101
Machine learning	13	87
Nurse	9	59
Deep learning	7	52
Robotics	7	46
Nursing education	6	41
Human experiment	5	40
Patient safety	5	38
Interpersonal communication	5	31
Patient care	5	24
Healthcare	5	23

DISCUSSION

Significance of Artificial Intelligence in Nursing Care Research

Early studies primarily focused on instrument development and nurses’ attitudes toward AI, including the work of Yılmaz et al. (18), which validated an attitude scale. Our bibliometric mapping shows that after 2020, most publications clustered around clinical documentation, decision support, and patient risk prediction, confirming a clear shift from conceptual exploration toward practical application of AI in nursing systems, including the development of tools for managing pressure injuries and incontinence-associated dermatitis (19), as well as the implementation of

AI applications in nursing documentation (20). In addition, studies have examined the use of generative AI to support clinical excellence and administrative efficiency in healthcare (21) and to validate predictive models for postoperative delirium using real-world patient data (22). These examples demonstrate that research on AI in nursing has shifted from conceptual discussions toward practical implementation in clinical settings.

Most publications are original research articles, with only a small proportion consisting of study protocols or theoretical papers. Thematically, the research can be mapped into several key areas. First, the geographic distribution of AI-related nursing research shows dominance by the United States (13 articles), followed by China (10

and Japan (7). Other significant contributors were Bangladesh, Germany, South Korea, and Taiwan, with 3 articles each, and Australia, France, and Hong Kong, with 2 articles each. In addition, several countries contributed a single article, including Thailand, Colombia, Belgium, Singapore, Denmark, Pakistan, Jordan, Norway, Finland, Saudi Arabia, Indonesia, Switzerland, and Portugal. This distribution suggests that research remains concentrated in countries with more advanced digital health infrastructures, while contributions from developing countries remain limited. This also opens opportunities for cross-country collaborative research to expand the application of AI in diverse healthcare contexts. Our bibliometric network analysis shows that collaborations are concentrated in a few clusters, with the United States serving as the central hub, while links among developing countries remain sparse. Institutional collaborations were also limited, often confined to regional networks rather than global partnerships. These findings reinforce the need for broader, more inclusive international cooperation to ensure that AI applications in nursing address diverse healthcare realities.

Articles from the United States occupy the top position, focusing on the application of AI to improve clinical and administrative efficiency (21). European countries such as Germany and the United Kingdom contributed through studies on AI-based decision support systems for wound care and nursing documentation (19,20). Meanwhile, Asian countries, particularly Japan and China, have shown significant progress in healthcare-related AI applications; however, contributions specifically targeting nursing remain limited. This gap, particularly between developed and developing countries, indicates uneven research coverage and underexplored areas, including nursing education, ethical frameworks, and patient-centered adoption. Addressing these gaps is critical to ensure that AI integration in nursing not only advances technological innovation but also supports equitable practice, ethical safeguards, and workforce readiness.

In terms of publication type, most articles are original research studies, with themes ranging from the development of instruments to assess nurses' attitudes toward AI (18) to the validation of predictive models for clinical conditions such

as postoperative delirium (22) to the use of generative chatbots in nursing education. This distribution indicates that the utilization of AI in nursing encompasses clinical, managerial, and educational dimensions. However, contributions from developing countries, including those in Southeast Asia, remain very limited. This highlights a global gap in nursing-related AI research and offers significant opportunities for international collaboration and cross-context research to ensure that AI applications are tailored to the needs of diverse healthcare systems.

The analysis using VOSviewer shows that the findings have both theoretical and practical implications for advancing research on the application of Artificial Intelligence in nursing care. The metadata analysis provides researchers and practitioners with a deeper understanding of the assumptions, trends, and emerging findings in this field. The bibliometric analysis using VOSviewer highlights frequently studied variables in the application of AI in nursing and identifies underexplored aspects that may serve as a foundation for future investigations. From a practical perspective, the systematic review of the literature using VOSviewer supports the sustainable implementation of AI in nursing practice and fosters digital transformation across healthcare institutions worldwide.

Based on the mapping of research and the review of previous studies, a noticeable gap remains. Most of the research on the application of Artificial Intelligence in nursing has thus far been conducted in developed countries with strong technological infrastructures. This limits generalizability, as relatively few studies have examined the context of developing countries, where healthcare resources and technological readiness are more constrained.

From a theoretical perspective, this line of research contributes to strengthening the foundation of technology-based nursing concepts. For example, Yilmaz et al. (18) emphasized nurses' attitudes and readiness toward AI adoption, thereby expanding the theoretical basis for understanding the acceptance of digital innovations in nursing practice. Other studies have linked AI integration with frameworks such as evidence-based and precision nursing, opening pathways for nursing theories to become more adaptable to technological advances.

From a practical perspective, existing studies demonstrate that AI can deliver tangible benefits by improving the accuracy of clinical assessments, enhancing documentation efficiency, and supporting faster decision-making (19,20). In addition, AI has the potential to support nursing education through simulation and chatbot-based interactions, as evidenced by recent studies on the use of ChatGPT in nursing education. However, several challenges must also be considered, including ethical concerns, patient data protection, and limitations in nurses' digital competencies. These practical implications highlight the need for future research to examine not only the technical aspects of AI but also the humanistic dimensions, including nurses' acceptance of technology and its impact on the nurse-patient relationship.

Artificial Intelligence (AI) has advanced more rapidly in medicine than in nursing, opening significant opportunities for further nursing research. In medicine, AI applications such as deep learning, machine learning, and natural language processing (NLP) have been widely utilized across various tasks, ranging from disease diagnosis and pathology analysis to drug discovery, with clear evidence of improved diagnostic accuracy, patient management, and operational efficiency (1,23,24). These developments underscore both the potential and the challenges of AI, including issues of patient autonomy, privacy, and algorithmic bias (25). In contrast, the integration of AI in nursing is still evolving, with current applications primarily focused on clinical decision support, workflow efficiency, and patient risk prediction (26,27). While these applications can reduce workload, save resources, and improve patient outcomes, nursing continues to face challenges related to digital literacy, workflow integration, and ethical acceptance. However, this slower pace of adoption may also be beneficial, as it provides time to integrate ethical safeguards, ensure data transparency, and address potential bias. These concerns were sometimes overlooked during the earlier adoption of AI in medicine (30,31). This disparity highlights the gap between AI applications in medicine and nursing, suggesting the need for greater nurse involvement in the development and implementation of AI to ensure alignment with nursing values and to strengthen

adoption (32-34). Consequently, the slower pace of AI integration in nursing compared to medicine should not be regarded as a weakness but rather as an opportunity to develop nursing-specific AI frameworks that integrate technological innovation with the ethical principles that are central to nursing practice.

The implementation of Artificial Intelligence (AI) in nursing in developing countries faces several major challenges, particularly regarding digital literacy and infrastructure. The digital literacy gap remains evident, as many nurses are accustomed to using basic digital technologies but lack an adequate understanding of AI applications in nursing practice (35,36). To address this, frameworks such as AI-ABCs have been introduced to provide foundational knowledge about AI, its benefits, challenges, and core components (37,38). However, adoption remains limited, necessitating the development of formal training programs and the integration of AI-related content into nursing curricula (39-41). Our bibliometric analysis found that fewer than one-fifth of studies originated from developing countries, underscoring this infrastructure gap and the urgent need to strengthen digital capacity and educational support in these regions.

In addition, infrastructure limitations pose significant barriers, including poor digital connectivity, limited access to advanced technologies, and data fragmentation (42,43). These challenges are compounded by financial constraints, as the high costs of AI implementation remain prohibitive for healthcare institutions in developing countries (44,45). Other obstacles include weak organizational support for management and ethical issues, particularly related to patient privacy, algorithmic bias, and the need for clear regulatory frameworks (46,47). Strategies such as developing digital infrastructure, improving AI literacy among healthcare workers, fostering public-private partnerships, and formulating strong regulatory frameworks are critical to promoting the ethical and effective application of AI in nursing within developing contexts.

The implementation of AI in nursing also presents ethical challenges, particularly concerning trust between nurses and patients. Ethical concerns include patient data privacy and

security, accountability, algorithmic transparency, and the preservation of patient autonomy in decision-making.

CONCLUSION

This study highlights the evolving landscape of Artificial Intelligence (AI) in nursing through a systematic literature review and bibliometric analysis. The findings indicate that although AI applications in nursing are expanding rapidly, research distribution remains uneven across countries, institutions, and topics. Current research has primarily focused on clinical decision support, workload reduction, nursing education, and ethical issues concerning patient data, autonomy, and nurse–patient trust. Nevertheless, the integration of AI into nursing practice still lags behind that in medicine, primarily due to infrastructure limitations and digital literacy gaps that must be addressed to realize its benefits fully.

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