

# Artificial Intelligence Applications in Nursing: A Bibliometric Analysis

## ABSTRACT


**Objective:** This bibliometric analysis aimed to shed light on future research and offer a new perspective by examining the use of artificial intelligence in nursing from a broader perspective.


**Methods:** The Web of Science database was used to identify the relevant studies. Studies containing the keywords "artificial intelligence", "machine learning" and "nursing" (n=32) were included. While scanning, only studies in English and Turkish were considered, and only studies published between 2000 and 2023 were evaluated.

**Results:** According to the publication years, 5 studies were conducted in 2019, 7 in 2020, 6 in 2021, 6 in 2022 and 5 in 2023. The main topics of the studies were management information systems, critical care, and oncology. Roschelle Fritz was identified as the most prolific author. *The Journal of Nursing Management* had the highest number of publications. Most artificial intelligence research in nursing has been conducted in the United States.

**Conclusion:** Despite the recent growth, studies on artificial intelligence applications in nursing remain limited. To address healthcare challenges, organizations should support artificial intelligence research and integrate it into nursing education to enhance innovation and improve patient care.

**Keywords:** Artificial intelligence, bibliometric analysis, machine learning, nursing, nursing care.

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## Introduction

Artificial intelligence (AI) applications in nursing have the potential to contribute significantly to patient diagnosis and evaluation, facilitating the creation of individualized care plans tailored to patients' specific needs and enabling the early detection of potential complications through continuous monitoring of health data. Furthermore, these applications can provide valuable support for medication management, patient education, and counseling. AI applications can alleviate nurses' workload, transform nursing practices, enhance the quality of patient care, and improve healthcare efficiency. Despite certain challenges in the development and implementation of AI systems, substantial effort has been made to address and mitigate these obstacles.

The concept of AI has gained prominence with advancements in technology and the growing need to execute complex tasks quickly and accurately. AI is defined as a system of sophisticated algorithms capable of performing functions, such as reasoning, perception, decision-making, problem-solving, and communication, employing a learning style similar to that of humans (Robert, 2019; Alp et al., 2023). These developments, coupled with the integration of big data into daily life and improved data accessibility, have facilitated the widespread application of AI across various domains, including engineering and healthcare.

The use of AI is becoming increasingly prevalent due to its ability to analyze comprehensive and complex clinical data, driven by factors such as increased life expectancy, the rise in chronic diseases, and advancements in diagnostic, treatment, and care technologies. In nursing, AI technologies are employed to classify patient data, conduct risk analyses, develop patient care plans, and enhance the efficiency of information processing and decision-making (Buchanan et al., 2021). The integration of technology into nursing education, research, and practice positively affects nurses' professional development and enhances the quality of patient care. Furthermore, the utilization of AI in areas such as clinical decision-support systems reduces costs, minimizes medical errors, and ensures accessibility and continuity of healthcare services (Cetin & Eroglu, 2020). AI applications, introduced alongside technological advancements, enable nurses to access information more efficiently and support improved communication within healthcare teams. Integrating AI into hospital systems is expected to reduce nurses' workload. As studies in the field of AI continue to grow, it is essential for nurses to effectively utilize technology, develop evidence-based practices by conducting further research in this area, and enhance their

knowledge (Bilgili & Erdal, 2023). A comprehensive bibliometric analysis is required to reveal the current trends, gaps, and research intensity in the field of artificial intelligence in nursing.

Bibliometric analysis is a method that utilizes various techniques to classify studies in the literature based on criteria such as author, country, university, and journal, and to evaluate them through citation and performance analyses (Gaviria-Marin et al., 2019). In this study, bibliometric analysis was employed to systematically reveal the evolution, research intensity, and thematic focus areas in the field of artificial intelligence in nursing, offering a quantitative foundation for identifying research gaps and guiding future studies. Literature indicates that AI applications in nursing encompass studies employing sensor technologies and big data analysis, focusing on issues such as pressure injuries, hospital-acquired infections, and elderly care.

This bibliometric study aimed to offer a comprehensive perspective on the utilization of AI in nursing while providing insights for future clinical and scholarly research. By analyzing the publication trends between 2000 and 2023, we present an overview of AI applications in the nursing field and their evolution over time.

## Research questions

Answers to the following questions were sought from the bibliometric analysis:

- What is the distribution of studies on AI in nursing indexed in the WoS across different Web of Science subject categories?
- How has the annual publication trend of studies on AI in nursing indexed in WoS evolved over time?
- What is the distribution of studies on AI in nursing according to the specific citation indexes within the WoS database in which they are cataloged?
- What is the distribution of studies on AI in nursing according to the number of citations received?
- Which journals have published the most studies on AI in nursing indexed in WoS, and what is the distribution of publications across these journals?
- Who are the leading authors contributing to studies on AI in nursing indexed in WoS, and what is their publication distribution?
- In which countries are studies on AI in nursing, indexed in WoS, predominantly conducted?
- What is the distribution of institutions actively conducting research on AI in nursing indexed in the WoS?
- What are the most frequently used keywords in studies on AI in nursing indexed in WoS and what trends do they reveal?

- What are the main topics addressed in studies on AI in nursing indexed in the WoS?

The predefined questions served as a structured framework to analyze and interpret trends, contributions, and key findings related to AI in nursing.

## Methods

### Study Design

This study employed a bibliometric analysis and adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Checklist. Only open-access studies published in peer-reviewed journals were included. The selected articles focused on artificial intelligence, machine learning, and their relevance to nursing. Articles written in Turkish or English and published between January 2000 and October 2023 were considered eligible for inclusion.

### Literature Searching and Data Collection

This study used the WoS Core Collection database to identify publications related to AI in nursing practice, education, and research. A bibliometric analysis was conducted to offer a new perspective and guide future studies. Although multiple databases are available for bibliometric studies, including WoS, PubMed, Embase, Scopus, and others, this study focused solely on the WoS database as the primary source. VOSviewer and the R-based Bibliometrix package (Biblioshiny, RStudio) were utilized for visualization. VOSviewer is a software developed for generating and visualizing bibliometric maps (van Eck & Waltman, 2010). In contrast, Bibliometrix is an open-source R-based tool, that uses the Shiny package environment to conduct quantitative research in scientometrics and bibliometrics, covering all essential bibliometric analysis methods (Aria & Cuccurullo, 2017). The records retrieved from the WoS database for publications dated from January 1, 2020, were used as the basis for this study. The research data were collected on October 23, 2023, using the search query: TS = ("artificial intelligence" OR "machine learning") AND "nursing". The initial scans identified 153644 publications.

After exclusions, 146262 publications remained for analysis. Several categories were excluded, including review articles (n=14522), letters to the editor (n=5813), early access articles (n=5198), meeting abstracts (n=3230), book

chapters (n=1933), letters (n=791), book abstracts (n=376), books (n=114), and news articles (n=202).

In the final stage, 32 open-access research articles meeting the inclusion criteria were identified using the keywords "artificial intelligence", "machine learning" and "nursing" in the WoS database. After data collection, scientific mapping was carried out using VOSviewer (v.1.6.19) and the R-based Bibliometrix package (RStudio v.4.1.4).

### Ethical Considerations

This study utilized secondary data obtained from studies retrieved from the WoS database. As the study did not involve human participants or human-derived materials, ethical committee approval was not required.

## Results

### Trends in Publications

In this bibliometric analysis, publications were examined based on various criteria, including WoS categories, indexed databases, publication years, leading researchers, citation counts, prominent countries, number of publications per journal, contributing institutions and organizations, and most frequently used keywords. Tables and figures summarizing the findings were generated using data retrieved from the WoS database. Figure 1 shows the numerical data derived from the studies included in the analysis.

The included studies were categorized according to the WoS Science classification system. The analysis identified the following main research areas: nursing, management, education, critical care medicine, dermatology, interdisciplinary applications of computer science, medical informatics, oncology, and surgery (Table 1).

The indexing analysis showed that the selected articles were published in journals included in the Science Citation Index Expanded (SCI-E), the Social Sciences Citation Index (SSCI), and the Emerging Sources Citation Index (ESCI) (Table 2).

The year-based distribution showed that the first relevant publication appeared in 2014. The number of publications per year was as follows: 2020 (n=7), 2021 (n=6), 2022 (n=6), 2023 (n=5), 2019 (n=5), 2018 (n=1), 2015 (n=1), and 2014 (n=1) (Figure 2).



Figure 1.

Summary Data of Articles (n= 32)

Table 1. Distribution of Articles by WoS Category		
WoS Categories	Number of Articles	Article Percentage (%)
Nursing	32	%100.00
Management	4	%12.00
Education Scientific Disciplines	3	%9.37
Critical Care Medicine	2	%6.25
Dermatology	2	%6.25
Computer Science Interdisciplinary Applications	1	%3.12
Medical Informatics	1	%3.12
Oncology	1	%3.12
Surgery	1	%3.12

Table 2. Distribution of Articles According To the Index	
Index*	Publications (n)
Science Citation Index Expanded (SCI-E)	25
Social Sciences Citation Index (SSCI)	24
Emerging Sources Citation Index (ESCI)	7
* There are publications included in more than one index.	

### Highly Cited Articles

When the citation counts of the publications were analyzed, it was found that a total of 215 citations were received. Among these, 11 publications received nine or more citations, whereas 8 publications had no citations (Table 3). The United States (USA) was identified as the leading country in citation distribution, with 133 citations attributed to articles originating from this region (Figure 3).

### Analysis of Journal, Author, Institution, Country

Journal analysis showed that *The Journal of Nursing Management* was the most frequently preferred source, with four publications. Overall, the included articles were distributed across 24 different journals (Table 4).

In this study, 147 authors have contributed to the literature. Among those with two or more articles, four authors were prominent, with Fritz, Roschelle identified as the most prolific author (Table 5).

The distribution of publications by country revealed that studies on AI in nursing were conducted in 22 countries. Among these, the USA ranked first, with 16 publications (Table 6). The network map according to keywords: The analysis identified 90 academics from various institutions that conducted research on the subject. Institutions with two or more publications are highlighted in the analysis.

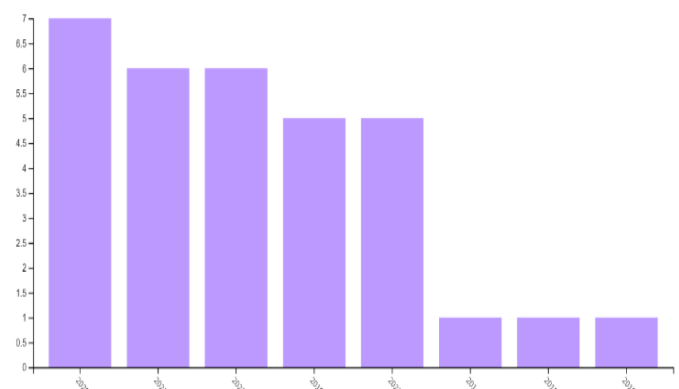


Figure 2.

Distribution of Articles by Publication Year (2014-2023)

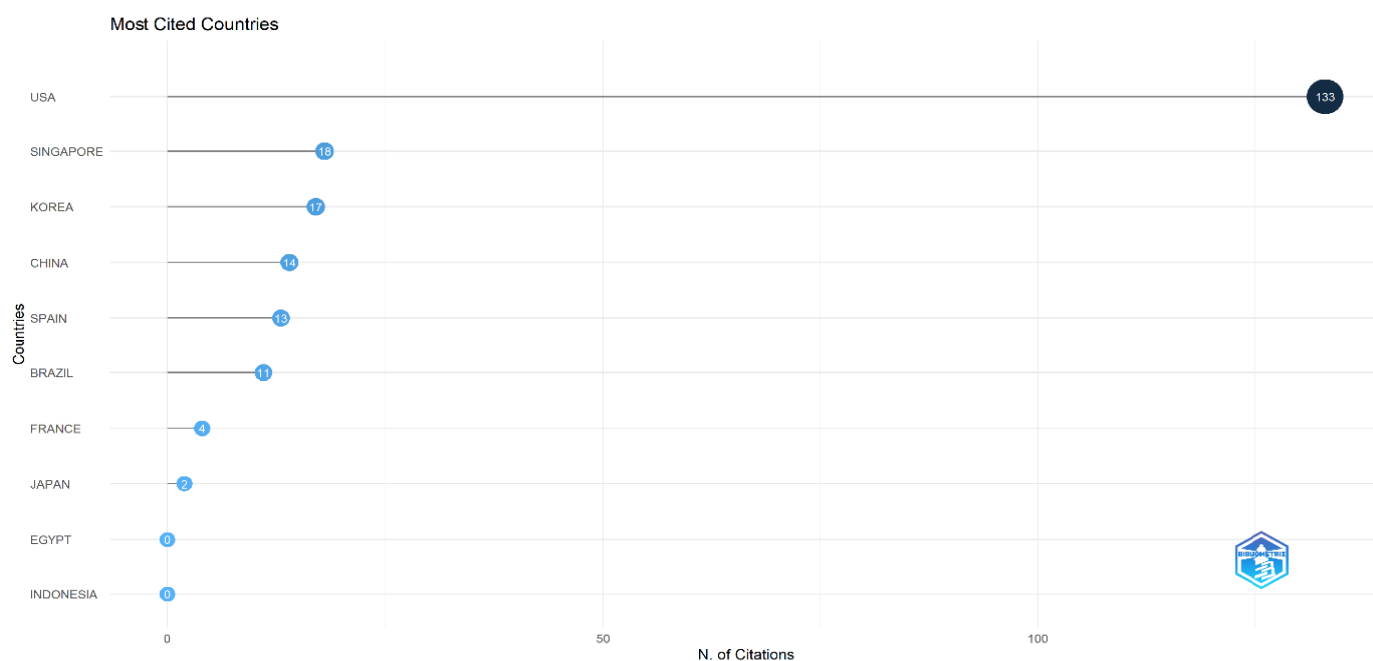


Figure 3.  
Listing of Studies by the Most Cited Countries

	Title	Year of Publication	Number of citations*
1.	The influence of the COVID-19 pandemic on technology: adoption in healthcare	2020	38
2.	A nurse-driven method for developing artificial intelligence in "smart" homes for aging-in-place	2019	31
3.	First experiences of high-fidelity simulation training in junior nursing students in Korea	2015	17
4.	Machine learning methods for identifying critical data elements in nursing documentation	2019	14
5.	Predictive modeling of pressure injury risk in patients admitted to an intensive care unit	2020	13
6.	Face and content validity of variables associated with the difficult-to-sedate child in the pediatric intensive care unit: A survey of pediatric critical care clinicians	2018	12
7.	The role of artificial intelligence in enhancing clinical nursing care: A scoping review	2022	11
8.	Mortality risk in homebound older adults predicted from routinely collected nursing data	2019	11
9.	Implementation of an artificial intelligence algorithm for sepsis detection	2020	9
10.	Knowledge discovery with machine learning for hospital-acquired catheter-associated urinary tract infections	2020	9
11.	The application of big data and the development of nursing science: a discussion paper	2019	9

\*Journals with 9 or more citations are included.

Journals	Number of Articles*	Article Percentage (%)
Journal of Nursing Management	4	%12.12
Nurse Education Today	3	%9.09
Nursing Outlook	3	%9.09
International Journal of Nursing Studies Advances	2	%6.06
Nursing Research	2	%6.06
*Journals with 2 or more articles are included.		

Authors	Number of Articles*	Article Percentage (%)
Fritz, Roschelle	3	%9.09
Dermody, Gordana	2	%6.06
Cook, Diane J.	2	%6.06
Westra, Bonnie L.	2	%6.06

\*Authors with 2 or more publications are included.

Countries	Number of Articles*	Article Percentage (%)
United States of America (USA)	16	%48.48
Singapore	3	%9.09
Australia	2	%6.06
Brazil	2	%6.06
Japan	2	%6.06
China	2	%6.06
Taiwan	2	%6.06

\*Countries with 2 or more publications are included.



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growth in research momentum is likely driven by advancements in AI technology and its demonstrated effectiveness in the healthcare sector. Studies exploring the application of AI in healthcare are expected to continue increasing in the coming years (Demirkol et al., 2022; Kaynak, 2021; Parlar & Esen, 2023).

An analysis of the distribution of studies according to WoS categories revealed that the most prevalent research areas were nursing, management, education disciplines, intensive care, dermatology, interdisciplinary computer science, medical informatics, oncology, and surgery. A significant number of studies in these fields are attributed to the integration of clinical decision-making systems in managing patient care and addressing the challenges associated with chronic diseases. Moreover, the use of AI technologies in nursing education, management processes, and care delivery as well as in determining diagnosis and treatment methods is steadily increasing (Akerman et al., 2022; Coiera, 2003). The field of nursing is expected to witness considerable growth in AI applications, positioning itself as a key area for future research and innovation in this domain.

SCI-e, SSCI, and ESCI emerged as the most prominent indices in the indexing analysis. These indexes are commonly preferred for publishing innovative research, such as studies on artificial intelligence, owing to their high impact factors and adherence to rigorous academic standards.

An analysis of all the publications revealed 215 citations between 2014 and 2023. The most cited study, with 38 citations, was the article titled "The Influence of the COVID-19 Pandemic on Technology: Adoption in Health Care", authored by Clipper in 2020 (Clipper, 2020). The global focus on COVID-19 research and accelerated use and development of technology during the pandemic may have significantly contributed to the high citation count of this study. This trend reflects the natural outcome of increased research attention towards specific, impactful topics during this period (Table 3).

An analysis of the distribution of publications by country revealed that the United States had 16 publications. This prominence can be attributed to rapid advancements in AI technologies within the country and their integration into clinical nursing practices. In the USA, AI technologies are extensively used to analyze treatment protocols, enhance diagnostic processes, select medications with minimal side effects, and plan nursing care based on clinical patient data. These developments highlight the USA's leadership in leveraging AI to advance health care and nursing practices (Jiang et al., 2017; Maddox et al., 2019; Reddy et al., 2019).

The analysis revealed that the majority of publications were published in the Journal of Nursing Management. Research combining AI with data mining techniques is particularly prominent in nursing care management, especially in clinical decision-support systems. The analysis of WoS categories indicates that the most prevalent topics in AI research within the nursing field significantly influence the choice of journals for publication. This alignment suggests that research trends and thematic focus are key determinants of journal selection for AI-related nursing studies.

A total of 120 keywords were identified in the publications, of which 90 were analyzed in detail. An evaluation of the most frequently used keywords and their combinations revealed that "artificial intelligence" was the most prominent, followed by "machine learning". Other commonly used keywords included "convolutional neural network", "deep learning", "image diagnosis", "early detection", "data mining", "data science", "data processing", "decision-support", and "decision trees". In the visual mapping, the sizes of the circles represent the frequency of keyword usage, whereas the similarity in circle colors and the connecting lines between circles illustrate the relationships and co-occurrence of keywords (Figure 4). From a technical perspective, the keywords reveal that while AI is applied across various domains, terms such as "deep learning", "convolutional neural networks", and "image diagnosis" prominently emerge, suggesting the extensive use of image classification techniques in this field. Additionally, the frequent use of "decision tree", a supervised learning algorithm, indicates its preference for classification tasks. Based on these keywords, it can also be inferred that many studies have focused on predictive analysis using datasets. This aligns with the notion that research should emphasize clinical decision-making in diagnosing diseases and providing nursing care. In nursing care practices, keywords such as oral assessment, oral care, dental hygiene, COVID-19, patient care, intensive care, chronic wounds, wound evaluation, end-of-life care, heart failure, and oncology nursing frequently appear. This suggests that the studies primarily aimed to enhance the nursing process in critical areas, such as intensive care. The

word cloud (Figure 5), visualizing the most used keywords, highlights "care" as the most recurring term, followed by "risk", "health", "artificial intelligence," "experience", and "validation". These findings indicate a research focus on the effectiveness of AI in stages, such as risk assessment in nursing care and the validation of care outcomes.

**Limitations:** This analysis is objective and provides an overview of general research trends on AI applications in

nursing, serving as a reference for researchers aiming to conduct more in-depth studies in this field. However, this study has certain limitations. The data used in this analysis were sourced exclusively from the WoS database, and only open-access peer-reviewed articles available in this database were included. The exclusion of studies on AI in nursing and healthcare published in databases other than the WoS represents a limitation of this study.

### Conclusion and Recommendations

The number of publications in the field of nursing has consistently increased since 2014 when the first study in this area was published. AI remains a current and rapidly evolving research focus in various disciplines. In nursing, the growing use of AI is driven by the need to process big data in healthcare, the ability to utilize complex datasets in clinical decision-making, and its positive impact on patient safety. Continued exploration of AI applications in nursing from diverse perspectives will further enrich the existing literature and provide guidance for future research. Notably, this analysis identified a lack of Turkish authors, studies, and journals related to nursing and AI among the reviewed publications. This gap highlights an opportunity for Türkiye to prioritize research in this domain, contributing to both the development of the literature and the advancement of AI applications in nursing practice.

**Ethics Committee Approval:** No interaction was made with any humans and/or animals and no information was collected. For this reason, ethics committee approval was not obtained.

**Informed Consent:** Since it was a bibliometric analysis and patients were not studied directly, informed consent was not obtained.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept - O.T.C, N.Y.A; Design- O.T.C; Supervision- N.Y.A; Resources- O.T.C; Data Collection and/or Processing- O.T.C; Analysis and/or Interpretation-N.Y.A, O.T.C; Literature Search- N.Y.A, O.T.C; Writing Manuscript- O.T.C; Critical Review- N.Y.A, O.T.C

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