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Digital Transformation In Nursing Management: A Systematic Literature Review Of Leadership, Technology Integration, And Patient-Centered Care

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Abstract

Background: Digital transformation has become a critical driver in improving healthcare quality, efficiency, and accessibility, particularly within nursing management. However, existing studies often examine technology adoption, leadership, and patient-centered care separately, resulting in fragmented understanding of their interrelationships in nursing management contexts.
Objective:
This study aims to synthesize evidence on how digital transformation is implemented in nursing management, examine the role of nursing leadership in technology integration, and evaluate its impact on patient-centered care and clinical decision-making.
Method: A Systematic Literature Review (SLR) was conducted following PRISMA 2020 guidelines using the Scopus database for publications from 2001–2025. Search strategies combined keywords related to digital transformation, nursing management, leadership, health informatics, and patient-centered care. From 323 records, 75 studies met inclusion criteria after screening, eligibility assessment, and full-text review. Bibliometric analysis was performed using Biblioshiny and VOSviewer to identify trends and thematic networks.
Result: Findings indicate that technologies such as electronic health records (EHR), telemedicine, artificial intelligence (AI), and clinical decision support systems significantly enhance service accessibility, personalization, and patient engagement. Nursing leadership plays a pivotal role in aligning technological innovations with clinical workflows, managing organizational change, and addressing risks related to data security and digital competency gaps. Nevertheless, challenges persist, including administrative burden, alert fatigue, privacy concerns, and uneven digital readiness among nurses.
Conclusion: Digital transformation in nursing management is a multidimensional process requiring strong, adaptive leadership and strategic integration of technology to achieve sustainable patient-centered care. This review proposes an integrative perspective linking leadership, digital systems, and clinical outcomes, and highlights future research needs in longitudinal evaluation, contextual validation, and socio-ethical impacts of digital healthcare transformation.

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INTRODUCTION

Digital transformation in healthcare is characterized by the adoption of information and communication technology (ICT) which aims to improve the quality, efficiency, and accessibility of patient care (Canfell et al., 2024). These changes not only have an impact on the healthcare system as a whole, but also present new challenges and opportunities in nursing management, especially

related to role changes, digital competency improvement, and data-driven decision-making (El-Bassal, 2025). Various digital innovations such as *electronic health records* (EHR), telemedicine, *consumer health informatics* (WHO), *clinical decision support* (CDS), and artificial intelligence (AI) are increasingly integrated into modern clinical and nursing practices, thus demanding organizational readiness and adaptive and visionary leadership. Digital transformation contributes significantly to strengthening *patient-centered care* by enabling the patient's active involvement in planning and decision-making regarding their care. Through the use of digital applications and platforms, patients transform from passive consumers to *prosumers* who participate in the design of care flows with healthcare providers (Vijver et al., 2023). EHR integration with mobile apps allows patients to monitor health conditions and risks in a timely manner *real-time*, so that nursing interventions can be planned more proactively and personalized. In addition, the use of telemedicine and digital platforms increases patient satisfaction by facilitating remote consultations, reducing the need for physical visits, and providing health information tailored to the individual needs of patients (Sutter et al., 2022).

Telemedicine enables the delivery of remote healthcare services that are able to reach patients in remote areas and improve continuity of care (May et al., 2021; Roza & Sari, 2023). A study in Padang City showed that the implementation of telemedicine improved the accessibility of community nursing, with the majority of users coming from younger age groups who had better technology literacy, while research in Germany reported that telehealth interventions were able to improve service coordination and reduce unnecessary hospitalizations (May et al., 2021). In addition, CHI integrates data *real-world* through digital technologies such as *wearable devices*, application *mobile health* (mHealth), EHR, and the Internet of Things (IoT) to enable on-the-fly health monitoring *real-time* and disease prevention, so that nursing management can design more proactive and personalized interventions (Canfell et al., 2024). From a service quality perspective, digital transformation improves access and coordination of health services through the use of mHealth technology that accelerates the process of registration, scheduling, and follow-up of treatment, while strengthening collaboration between health professions. The digital system also supports a more robust data-driven clinical evaluation of treatment processes and adherence, thereby reducing the variation of clinical practice and improving the consistency of service standards. Furthermore, automation and analysis of clinical data enables faster deployment of clinical guidelines and best practices across service units, supporting continuous improvement of healthcare quality (Ibrahim et al., 2022). However, digital transformation also brings important implications for patient safety that relies heavily on information quality and data security. Various patient safety incidents are often associated with problems *information quality*, such as delays, loss, incompleteness, or errors in EHR and CDS systems, which can potentially lead to inaccuracies in diagnosis and therapy (Fadahunsi et al., 2022). In addition, weak data protection and confidentiality in the management of consumer data *eHealth* can threaten patient privacy and lower trust in the health digital system (Santoso & Andriana, 2023). Therefore, the implementation of a standardized and interoperable healthcare digital architecture is crucial to reduce data fragmentation, support more accurate clinical decision-making, and ensure continuity of services between healthcare facilities. The development of AI further strengthens the digital transformation of nursing through its application in medical image recognition, diagnosis support, administrative management, and nursing documentation (Carter-Templeton, 2024; Mucci et al., 2024). AI systems such as virtual assistants and surveillance alarms contribute to continuous monitoring of patients' conditions and reduce the administrative burden on nurses, allowing nurses to focus more on direct care to patients (Areias et al., 2024). This digitalization requires nurses to have technology literacy, EHR management skills, and AI-based data analysis skills (Lagadec et al., 2024), as affirmed by *Nursing and Artificial Intelligence Leadership Collaborative* that encourage active involvement of nurses in the development and implementation of AI to remain clinically and ethically relevant (Ronquillo et al., 2021).

In that context, *nursing leadership* Playing a strategic role in directing and managing the digital transformation of healthcare. Nursing leadership plays a role in articulating organizational vision, aligning technological innovation with nursing practice, and facilitating change management at the unit and institutional level (Shachak et al., 2024). The increase in EHR adoption post-HITECH Act with 80.5% of hospitals in the United States having used EHRs in 2015 underscores the importance of nursing leadership in ensuring the integration of technology that aligns with clinical

workflows, staff training, and patient data security and interoperability (Joseph et al., 2022; Kummer et al., 2021; Samad et al., 2023). Further, *nursing leadership* also plays a crucial role in the development of telehealth, the integration of CDS to prevent *alert fatigue*, as well as the application of AI that is ethical and in accordance with regulations, so that digital transformation of health can run effectively, safely, and oriented towards improving the quality of services and clinical outcomes of patients (Cho et al., 2021; Kwan et al., 2020).

Although digital transformation in healthcare has been widely studied, the existing literature still shows conceptual fragmentation between leadership, digital technology adoption, and patient-oriented service outcomes. Most studies tend to address aspects of technology, such as EHRs, telehealth, or artificial intelligence, separately from nursing leadership roles and their implications for *patient-centered care*. As a result, the interdependent relationship between leadership, technology, and clinical outcomes and patient experience has not been comprehensively depicted. In addition, there is still limited *systematic literature review* (SLR) that specifically integrates the perspective of *nursing leadership*, the use of digital technology, and *patient-centered care* in the context of nursing management. Existing studies generally focus on clinical or technical dimensions, while strategic and managerial aspects such as organizational decision-making, change management, and the development of nurses' digital competencies have not been systematically synthesized in a single analytical framework. Furthermore, there is a gap in the synthesis of the literature on the managerial and organizational impact of digital transformation in the field of nursing. These impacts include changes in work structure, administrative burden, organizational culture, data governance, and the role of nursing leadership in ensuring patient safety and service quality. The limitations of a holistic understanding of these aspects demonstrate the need for an integrated study that is able to connect nursing leadership, digital transformation, and overall healthcare outcomes. This research aims to identify how digital transformation is implemented in the context of nursing management, especially in the use of various digital technologies to support managerial and service processes. In addition, this study aims to analyze the role of nursing leadership as well as the forms of digital technology integration used in supporting the effectiveness of nursing management. This study also aims to assess the impact of digital transformation on the application of *patient-centered care* models and decision-making processes in nursing practice. In line with these goals, research questions are focused on how digital transformation is implemented in nursing management, leadership approaches and what types of digital technologies are used to support nursing management, as well as how digital transformation affects *patient-centered care* outcomes and clinical decision-making processes.

METHOD

This study uses the Systematic Literature Review (SLR) method which refers to the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure that the process of searching and selecting articles is carried out systematically and transparently. The research data was obtained from the Scopus database with a publication year range of 2001–2025, which was selected due to the limited availability of the latest articles relevant to the research topic. The literature search was conducted using eight main keywords that were combined according to the focus of the study.

The article selection process follows the stages of PRISMA 2020, namely identification, screening, eligibility, and inclusion. At the identification stage, the search was conducted using a combination of the keywords "digital transformation" AND "nursing management", "leadership" AND "health informatics", "nursing management" AND "patient-centered care", as well as "health informatics" AND "digital transformation". The screening stage is carried out by removing duplicate articles and assessing suitability based on titles and abstracts, then continued with a full text review to determine the feasibility of the article according to the inclusion and exclusion criteria until articles that are worthy of analysis are obtained.

All selected articles are downloaded in CSV format, merged into a single file, and cleaned up using the OpenRefine application to eliminate duplication as well as irrelevant articles. Bibliometric analysis was then carried out using the Biblioshiny application to obtain key information related to publication patterns, citations, sources, authors, and state contributions. Visualization of relationships between articles, authors, and topics is done using VOSviewer in the form of Network Visualization and Overlay Visualization. Figure 1 is a diagram of the flow chart of this SLR research.

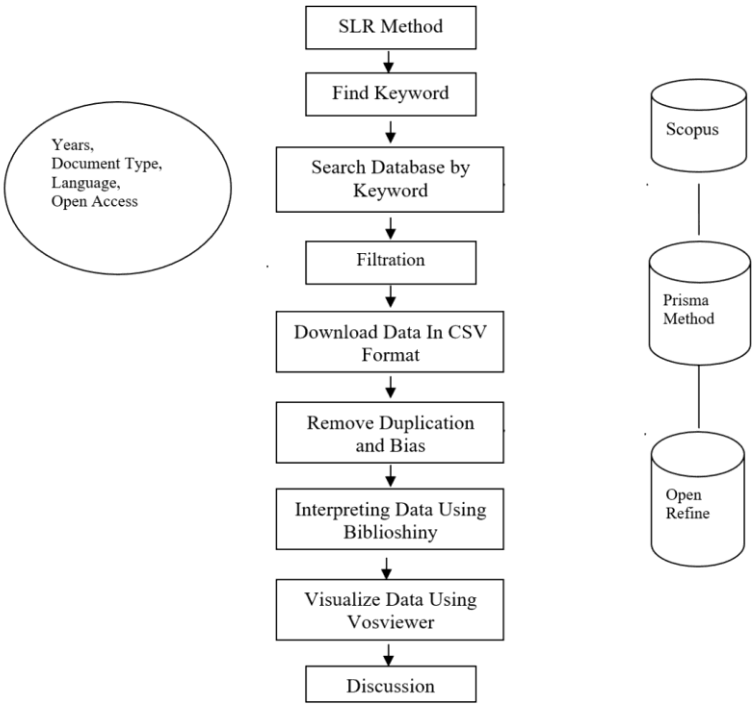

Image 1 Research Method Flow Diagram

Prism Method

The prism method is used to carry out the following data screening process, which is the step used in the method in figure 2:

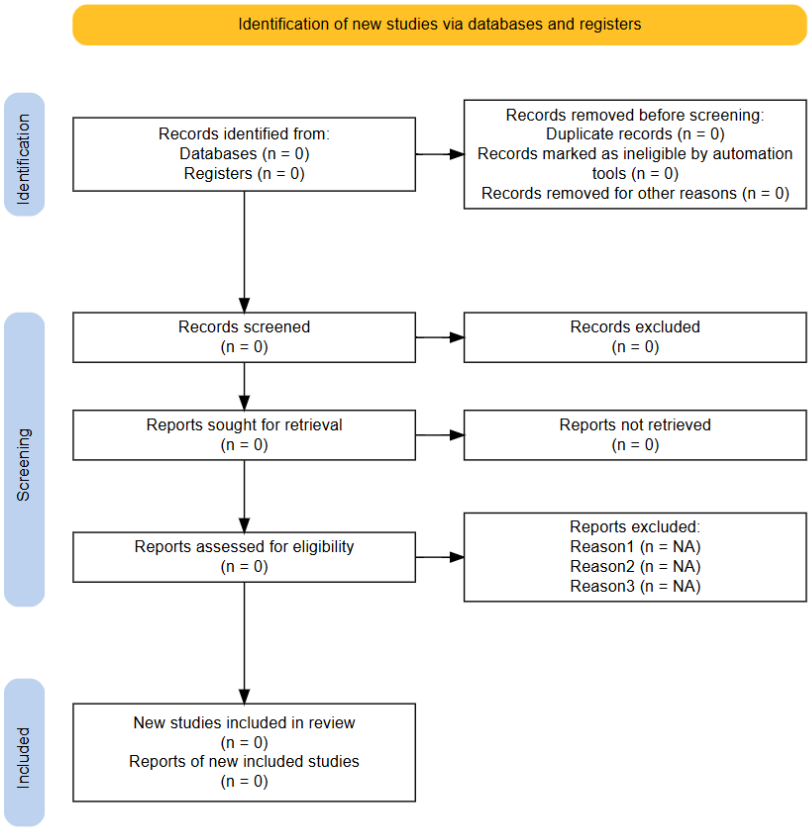

Image 2 Prisma Systematic Literature Review Method

In table 2 above, the process of selecting articles in this systematic review is carried out with reference to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines and is described in detail through the flow diagram in the PRISMA Figure above This process consists of four main stages, namely identification, screening, eligibility, and inclusion.

RESULTS AND DISCUSSION

Kajian Bibilometrik

In bibliometric analysis, the search strategy was carried out using Scopus data sources that were relevant to the research theme. Based on several initial keywords identified, four main keywords were selected, namely keywords that represent the implementation of digital transformation in nursing management, the role of leadership in the use of health informatics, the relationship between nursing management and patient-centered services, and the role of health informatics in supporting digital transformation in the healthcare sector. The articles obtained were then selected based on inclusion criteria, including peer-reviewed journal articles (research or review), focusing on nursing management and/or leadership with digital technology integration, discussing the impact on patient practice or service outcomes, written in English, final publication status, and having a number of citations of more than 10.

Keywords for the Implementation of Digital Transformation in Nursing Management

("digital transformation" AND "nursing management")

The data obtained are 5 articles that are limited to the years 2005-2025.

Keywords: the role of leadership in the use of health informatics

("Leadership" AND "health informatics")

The data obtained is 187 articles limited to the years 2005-2025.

Keywords: the linkage between nursing management and patient-centered services

("nursing management" AND "patient-centered care")

The data obtained is 90 articles limited to the years 2005-2025.

keywords used to explore the role of health informatics in supporting digital transformation in the healthcare sector.

("health informatics" AND "digital transformation")

The data obtained is 77 articles limited to the years 2005-2025.

From the data above, which initially numbered 359 articles, then exported to CSV, then CSV entered into Open refine data to filter duplicate data, which turned into 323 articles.

Data Analysis

Metadata	Description	Missing Counts	Missing %	Status
AB	Abstract	0	0.00	Excellent
DT	Document Type	0	0.00	Excellent
PY	Publication Year	0	0.00	Excellent
TI	Title	0	0.00	Excellent
TC	Total Citation	0	0.00	Excellent
DI	DOI	1	0.31	Good
AU	Author	3	0.93	Good
CR	Cited References	23	7.12	Good
SO	Journal	24	7.43	Good
DE	Keywords	37	11.46	Acceptable
ID	Keywords Plus	39	12.07	Acceptable
RP	Corresponding Author	56	17.34	Acceptable
C1	Affiliation	323	100.00	Completely missing
LA	Language	323	100.00	Completely missing
WC	Science Categories	323	100.00	Completely missing

Image 1 The meta data on DE/Keword is good.

Furthermore, the process of interpreting bilometric data can be carried out using the Bibliosiny application as follows. Data The main information as a whole is obtained is seen in the picture.

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2001:2026
Sources (Journals, Books, etc)	126
Documents	323
Annual Growth Rate %	2.81
Document Average Age	7.28
Average citations per doc	14.71
References	2602
DOCUMENT CONTENTS	
Keywords Plus (ID)	1939
Author's Keywords (DE)	970
AUTHORS	
Authors	1326
Authors of single-authored docs	42
AUTHORS COLLABORATION	
Single-authored docs	48
Co-Authors per Doc	4.55
International co-authorships %	0.3096
DOCUMENT TYPES	
article	215
book	5
book chapter	17
conference paper	36
editorial	4
erratum	1
letter	1
note	4
review	38
short survey	2

Image 2 Main information on the data sheet.

Based on the results of the bibliometric analysis, the research data covers a long publication period, from 2001 to 2026, which shows that the research topic has developed sustainably in more than two decades. During this period, there were 323 documents from 126 different sources, such as journals, books, and proceedings, with an annual growth rate of 2.81%, which indicates a consistent increase in publications although not very fast. The average document age of 7.28 years indicates that most of the literature used is still relatively relevant, while the average citation per document of 14.71 indicates that publications in this field have a fairly good level of scientific impact. Overall, the documents are supported by 2,602 references, reflecting the strong theoretical foundation of the research.

In terms of content, 1,939 Keywords Plus and 970 author's keywords were found, which shows the diversity of themes and research approaches in this field. Author contributions are also relatively high, with a total of 1,326 authors, although only 42 authors produce a single article. Author collaboration was relatively strong, shown by an average of 4.55 authors per document, although the percentage of international collaboration was relatively low, at around 0.31%, which indicates that research is still dominated by collaboration at the national or regional level. Judging from the type of document, publications are dominated by journal articles as many as 215 documents, which confirms that scientific journals are the main medium in disseminating research results in this field. In addition, there are 38 review articles, which show the existence of knowledge synthesis and mapping efforts, as well as 36 conference papers that reflect the dynamics of scientific discussions in academic

forums. Other types of documents, such as books, book chapters, editorials, and other documents, are relatively less numerous, so it can be concluded that scientific development in this field is mainly driven by the publication of journal articles and review articles that are empirical and conceptual in nature.

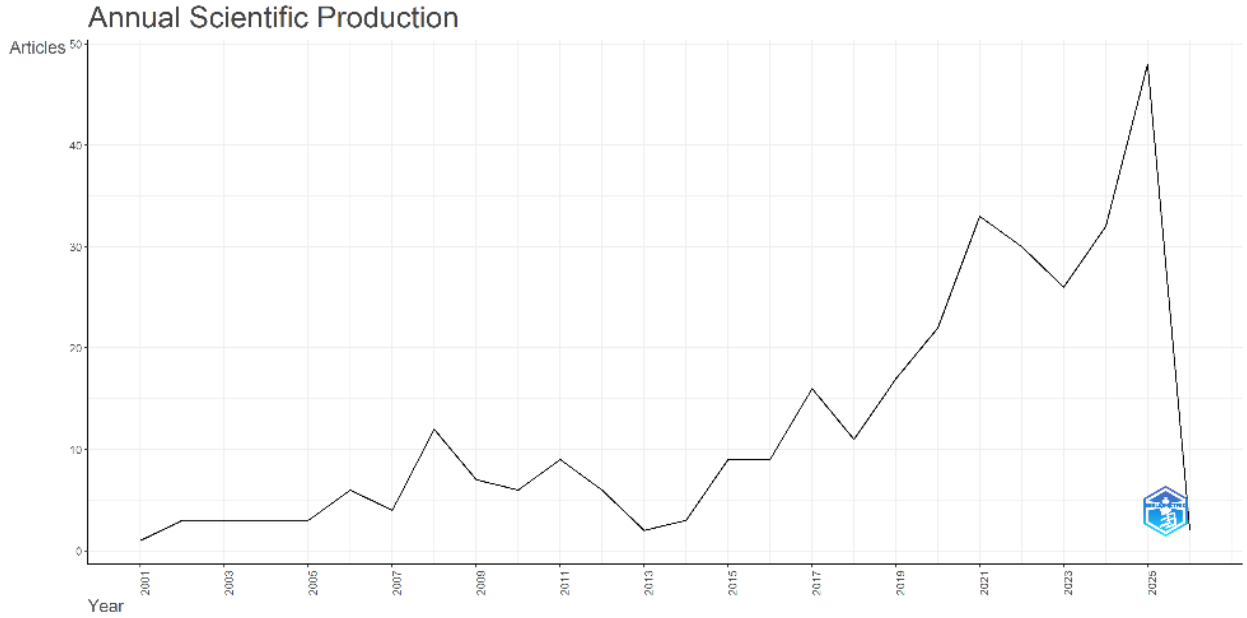

Image 3 Year-to-Year Growth Graph

Table 1 Annual Growth

Year	Articles
2001	1
2002	3
2003	3
2004	3
2005	3
2006	6
2007	4
2008	12
2009	7
2010	6
2011	9
2012	6
2013	2
2014	3
2015	9
2016	9
2017	16
2018	11
2019	17
2020	22
2021	33
2022	30
2023	26
2024	32

Year	Articles
2025	48
2026	2

Based on the data in the figure, it can be seen that the number of articles published from 2001 to 2026 shows a fairly significant upward trend, although it is accompanied by fluctuations in several periods. In the initial phase (2001–2005), the number of articles was still very limited and relatively stable, ranging from 1–3 articles per year, which indicates that the topic of study in that period did not receive much attention from researchers. Entering the period 2006–2012, there was a gradual increase with the number of articles being in the range of 4–12 articles per year, although there was still a decrease in certain years, such as 2009 and 2012. In the 2013–2016 period, the number of publications tended to fluctuate but showed an increase in direction, with a temporary peak in 2015 and 2016 of 9 articles each. A sharper increase began to be seen since 2017, where the number of articles reached double digits and continued to increase until it reached 22 articles in 2020. The most significant spike occurred in the period 2021–2025, with the number of articles reaching a peak in 2025 of 48 articles, indicating the high interest and intensity of research on the topic in recent years. The drastic decline in 2026 with only 2 articles is likely due to incomplete data because the year is still ongoing. Overall, this data indicates a strong and sustained growth trend of research interest in the topics studied, especially in the past decade.

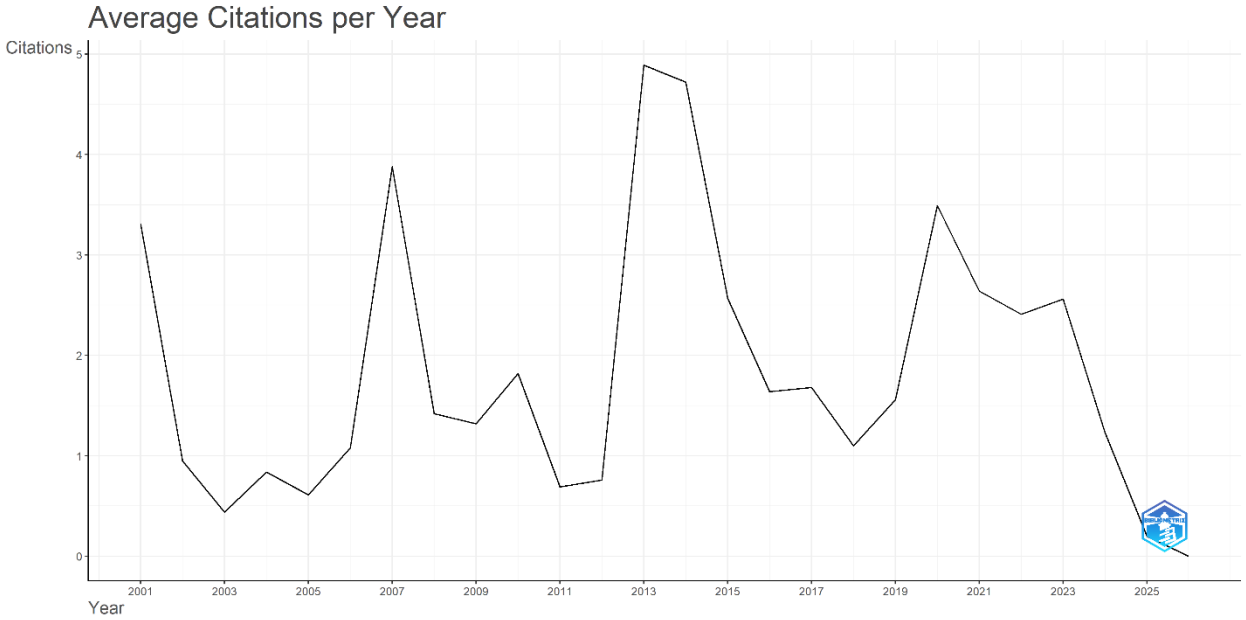

Image 4 Annual Citation Chart

It can be explained in the form of a table distribution as below.

Table 2 Annual Citation

Year	MeanTCperArt	N	MeanTCperYear	CitableYears
2001	86,00	1	3,31	26
2002	23,67	3	0,95	25
2003	10,67	3	0,44	24
2004	19,33	3	0,84	23
2005	13,33	3	0,61	22
2006	22,67	6	1,08	21
2007	77,50	4	3,88	20
2008	26,92	12	1,42	19
2009	23,71	7	1,32	18
2010	31,00	6	1,82	17

2011	11,11	9	0,69	16
2012	11,33	6	0,76	15
2013	68,50	2	4,89	14
2014	61,33	3	4,72	13
2015	30,89	9	2,57	12
2016	18,00	9	1,64	11
2017	16,75	16	1,68	10
2018	9,91	11	1,10	9
2019	12,47	17	1,56	8
2020	24,45	22	3,49	7
2021	15,85	33	2,64	6
2022	12,07	30	2,41	5
2023	10,23	26	2,56	4
2024	3,69	32	1,23	3
2025	0,40	48	0,20	2
2026	0,00	2	0,00	1

Based on the data in table 2 above, it can be seen that the dynamics of the impact of article citations published from 2001 to 2026 are analyzed through *the values of MeanTCperArt* (average total citations per article), *MeanTCperYear* (average citations per year), number of articles (N), and *CitableYears*. In the early period (2001–2007), although the number of published articles was still relatively small, *the MeanTCperArt* and *MeanTCperYear* values tended to be high, as in 2001 and 2007, indicating that the early articles had a strong influence and received high citations over a long period of time. This is supported by the large *CitableYears* value , indicating that the articles have a longer time to cite. Entering the period 2008–2014, the number of publications increased gradually, but the average value of citations per article and per year showed fluctuations. Some years, such as 2013 and 2014, show relatively high *MeanTCperYear* scores despite the limited number of articles, which indicates that the quality or relevance of the research topic in those years is high enough to attract academic attention. Furthermore, in the 2015–2020 period, the number of articles (N) increased quite significantly, but was accompanied by a downward trend in *the value of MeanTCperArt*, which indicates that an increase in the quantity of publications is not always followed by an increase in the average impact of citations per article.

In the most recent period (2021–2026), the number of articles peaked, specifically in 2025, but *the MeanTCperArt* and *MeanTCperYear* values declined sharply. This is mainly due to the low *CitableYears* value, which indicates that recent articles have not had enough time to obtain citations. Thus, overall these data show that articles published earlier tend to have a higher citation impact, while more recent articles show a low citation impact due to limited citation time, despite a significant increase in the number of publications.

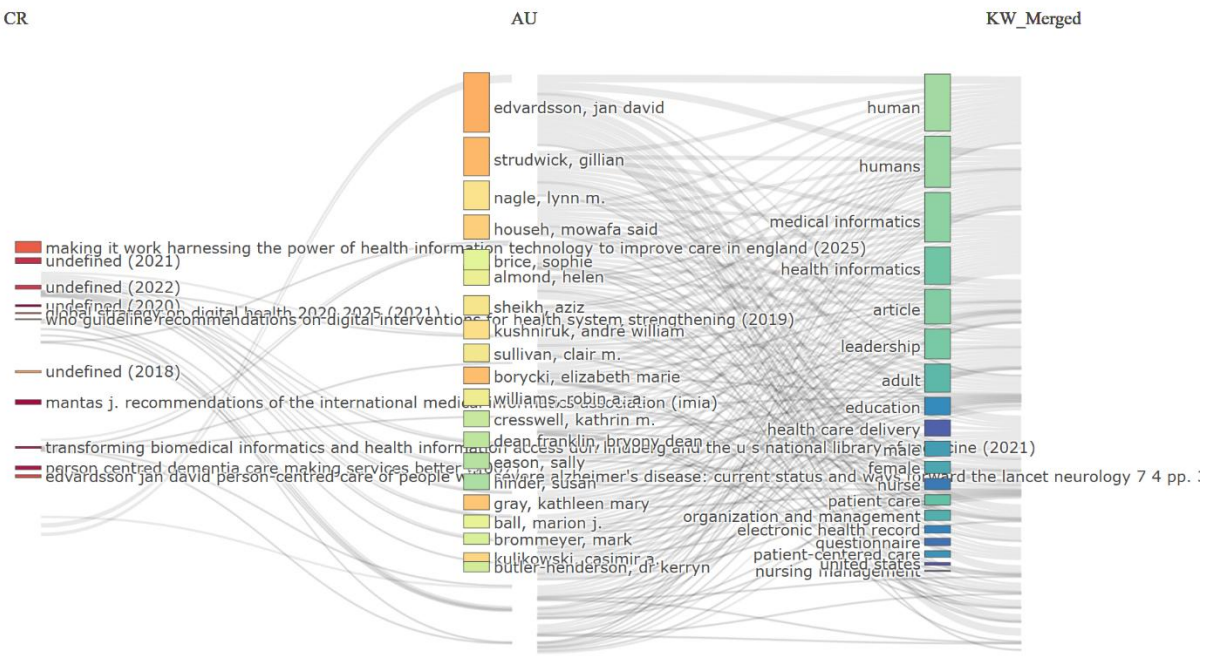

Image 5 diagram Three-Field Plot

Figure 7 above shows a *three-field plot* visualization that illustrates the relationship between reference sources (*CRs*), authors (*AUs*), and keywords (*KW_Merged*) in scientific publications. On the *CR* side, it can be seen that several key reference documents—such as reports, guidelines, and articles related to the development and implementation of health information technology and patient-centered care—are the basis for frequently used references. These references are then connected to a number of key authors in *the AU* column, such as Edvardsson, Jan David; Strudwick, Gillian; Nagle, Lynn M.; and Housh, Mowafa Said, who pointed to their central role in developing and disseminating studies in this field. Furthermore, the relationship between the author and the keywords in *the KW_Merged* column shows the dominant thematic focus of the research, including *health informatics*, *medical informatics*, *leadership*, *patient-centered care*, *nursing*, *health care delivery*, and *organization and management*. The density of the connecting lines suggests that the lead authors are not only prolific, but also contribute to a wide range of intersecting topics, particularly in the context of the digital transformation of healthcare and the role of leadership and nursing management. Overall, this visualization confirms the strong linkage between key references, key academic actors, and core research themes, reflecting the intellectual structure and direction of research development in the fields of health informatics and health service management.
For the most relevant sources in can be as shown in figure 8 below.

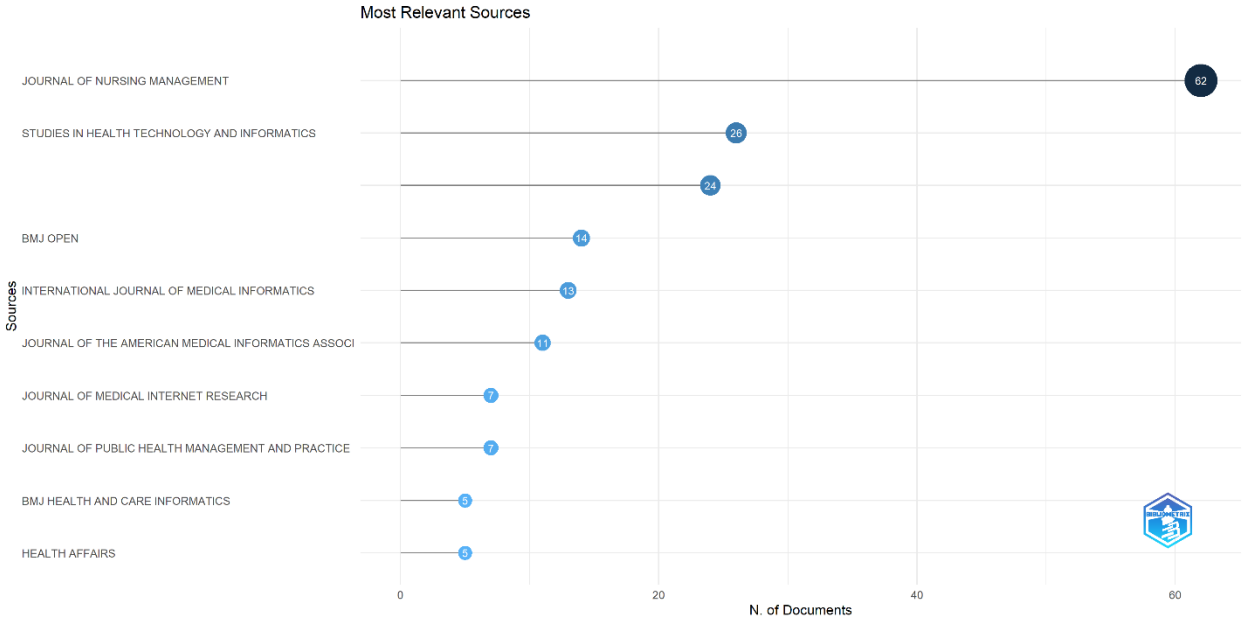

Image 6 Most relevan Source

Figure 8 above shows the most *relevant sources* that contain the most articles related to the research topic being analyzed. *The Journal of Nursing Management* occupies the most dominant position with the highest number of documents, which is 62 articles, which shows that this journal is the main and most consistent reference in discussing issues of nursing management, leadership, and the application of informatics in the context of health services. The next position is occupied by *Studies in Health Technology and Informatics* (26 articles) and *BMJ Open* (24 articles), reflecting the important role these journals play in facilitating the publication of interdisciplinary research, particularly at the intersection of technology, health information systems, and evidence-based practice.

Furthermore, *the International Journal of Medical Informatics* (14 articles) and *the Journal of the American Medical Informatics Association* (13 articles) show the significant contribution of the field of medical informatics to the development of this research. Other journals such as *the Journal of Medical Internet Research*, *Journal of Public Health Management and Practice*, *BMJ Health and Care Informatics*, and *Health Affairs* have a relatively lower number of publications, but they still play a role in enriching the perspective of the study, especially related to digital transformation, health policy, and health service management. Overall, this distribution of sources confirms that research topics are concentrated in reputable journals that focus on nursing management and health informatics, while reflecting the multidisciplinary character of the field of study studied.

Table 3 Sources' Local Impact

Source	h_index	g_index	m_index	TC	NP	PY_start
Journal Of Nursing Management	23	32	1,15	1227	62	2007
International Journal Of Medical Informatics	10	13	0,435	454	13	2004
Journal Of The American Medical Informatics Association	8	11	0,308	334	11	2001
Bmj Open	7	12	0,7	153	14	2017
Health Affairs	5	5	0,2	474	5	2002
Journal Of Public Health Management And Practice	5	7	0,2	75	7	2002
Studies In Health Technology And Informatics	5	7	0,313	63	26	2011
Bmj Health And Care Informatics	3	5	0,429	41	5	2020
Journal Of Medical Internet Research	3	7	0,429	173	7	2020

Methods Of Information In Medicine	3	4	0,136	48	4	2005
Yearbook Of Medical Informatics	3	5	0,158	41	5	2008
Applied Clinical Informatics	2	3	0,118	57	3	2010
Bmc Public Health	2	2	0,4	34	2	2022
Health And Technology	2	2	0,333	7	2	2021
Health Informatics Journal	2	3	0,133	24	3	2012
Health Policy And Technology	2	2	0,167	90	2	2015
Healthcare (Switzerland)	2	3	0,667	16	3	2024
Jamia Open	2	2	0,286	8	2	2020
Jmir Medical Education	2	2	0,667	5	2	2024
Journal Of Biomedical Informatics	2	2	0,083	30	2	2003
Journal Of Clinical Nursing	2	3	0,111	35	3	2009
Journal Of Interprofessional Care	2	2	0,167	15	2	2015
Journal Of Medical Systems	2	3	0,095	23	3	2006
Journal Of Public Health Research	2	2	0,182	19	2	2016

Based on the data in the figure, the Journal of Nursing Management appears to be the most dominant publication source with the highest h-index (23) and g-index (32) values, the total number of citations (TC) reaching 1,227, and the number of publications (NP) as many as 62 since 2007. This shows that the journal has a strong and consistent scientific influence over a long period of time. Furthermore, the International Journal of Medical Informatics and the Journal of the American Medical Informatics Association also occupy strategic positions with h-index values of 10 and 8, respectively, accompanied by relatively high total citations, which reflect the quality of the articles and the significant contribution to the development of science, although the number of publications is not as large as the top journals.

On the other hand, journals with medium to low h-index values, such as BMJ Open, Health Affairs, and the Journal of Public Health Management and Practice, continue to play an important role through a sizable number of citations, indicating the relevance and wide range of topics. Meanwhile, journals with an h-index of around 2–3, such as Healthcare (Switzerland), JMIR Medical Education, and Journal of Public Health Research, are generally relatively newer journals or have a more specific focus of study, so the impact of citations is still limited. Overall, this data indicates that the influence of journals is not only determined by the quantity of publications, but also by the quality, consistency of scientific contributions, and the length of time the journal has been active in the academic community.

Next is the Core Sources by Bradford'd Law data. This data is taken from the top 10 data.

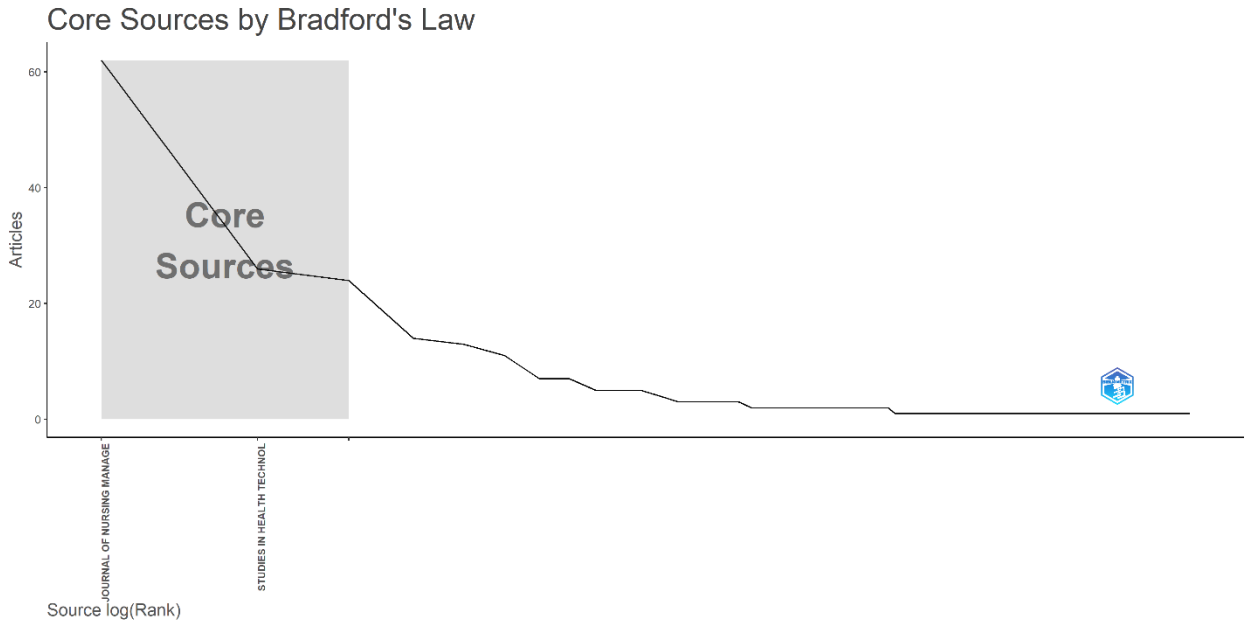

Image 7 Core Sources by Bradford'd Law

Based on the Core Sources by Bradford's Law graph, it can be seen that the distribution of articles follows the pattern of Bradford's Law, where a small number of journal sources account for the largest proportion of articles. At the beginning of the graph (core sources), there is a very sharp decline in the number of articles, indicating that only a few top journals such as *the Journal of Nursing Management* and *Studies in Health Technology and Informatics* are the main sources of publications and contribute the most significant to the total number of articles in this field of study. The shaded area clarifies the existence of the core zone, which is the group of journals with the highest productivity that plays a dominant role in the dissemination of scientific knowledge. Furthermore, after passing through the core zone, the curve shows an increasingly sloping decline to close to zero, which illustrates the presence of many other journals with relatively small and scattered article contributions. This pattern confirms the main principle of Bradford's Law that scientific literature is not evenly distributed, but rather concentrated in a small number of core journals, followed by subsequent zones with an increasing number of journals but lower productivity. Thus, this graph indicates that the focus of literature search and the main references in the field of research should be directed to the core journals, as they have the greatest influence and relevance compared to other sources.

Next is the Cumulate Occurrences graph data.

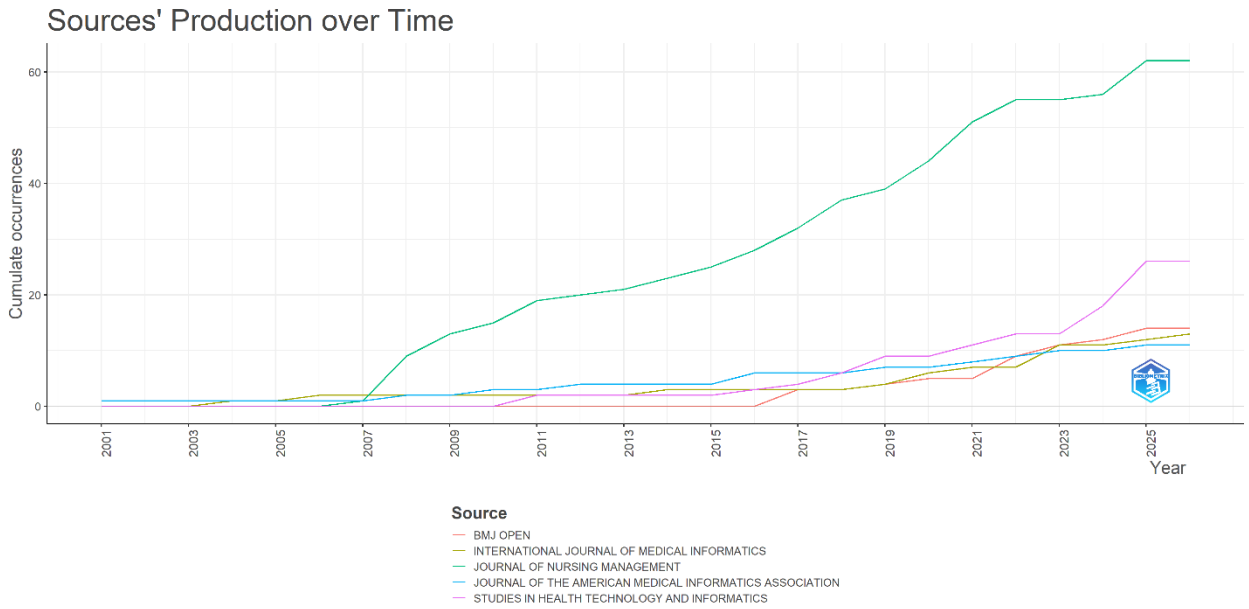

Image 8 Cumulate Occurrences

Based on the Sources' Production over Time graph, it can be seen that the publication productivity of various journal sources experienced a different trend of increase throughout the observation period. The Journal of Nursing Management shows the most consistent and significant growth, with cumulative increases starting in the mid-2000s and continuing to increase sharply until reaching the highest number of publications in recent years. This pattern indicates that the journal is the main and most active source in publishing articles related to the research topic being studied. Meanwhile, Studies in Health Technology and Informatics also showed a fairly rapid increase, especially after 2018, which indicates an increase in attention to health technology and informatics issues in recent years.

On the other hand, journals such as BMJ Open, International Journal of Medical Informatics, and Journal of the American Medical Informatics Association show more gradual growth with a relatively steady rate of improvement over time. Although the number of publications is not as high as that of major journals, the continued upward trend reflects the important role of such journals as consistent sources of support in the development of the scientific literature. Overall, this graph confirms the concentration of productivity in several key journals, while also showing the expansion of cross-source publication contributions as the topic of study develops over time.

Data authors Production over Time.

For Data authors, Production over Time. It can be seen in the table below.

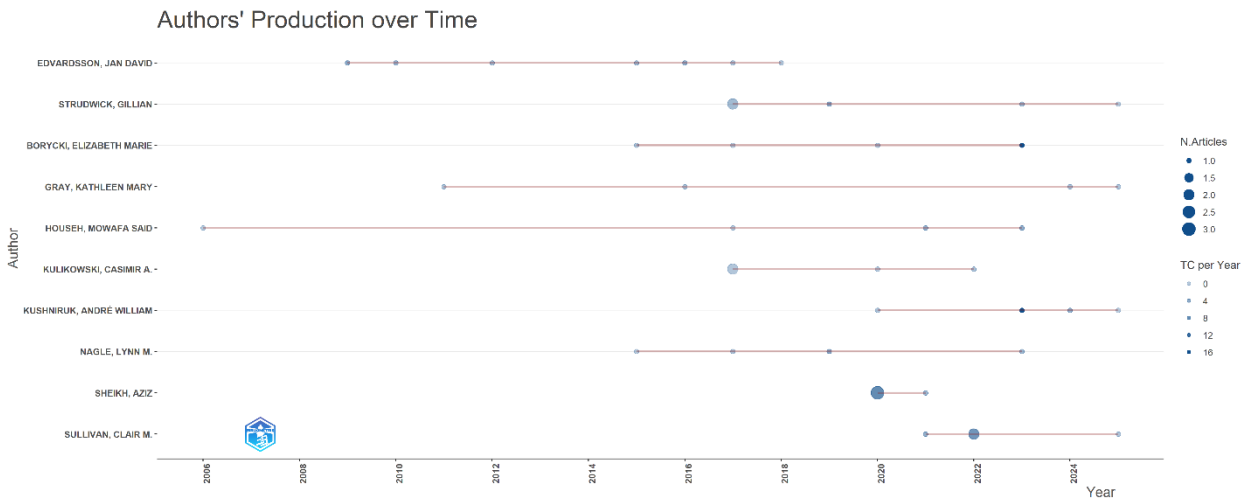

Image 9 authors Production over Time.

In figure 11 above, based on the Authors' Production over Time graph, it can be seen that the productivity of writers in this field of study is spread over different time spans with varying intensities. Some authors, such as Edvardsson, Jan David and Gray, Kathleen Mary, show long-term engagement with publications that appear consistently from the early years to the most recent period, although the frequency of the articles is relatively stable and not very close. The relatively small to medium size of the bubble signifies a limited number of articles per year, but the sustainability of such contributions reflects their important role in building and sustaining scientific discourse in this field. On the other hand, authors such as Strudwick, Gillian, Borycki, Elizabeth Marie, and Sullivan, Clair M. show a pattern of productivity that is more concentrated in certain periods, particularly after 2018, with larger bubble sizes indicating an increase in the number of articles and citations in those years. This indicates that there is a phase of research intensification that may be influenced by increasing topic relevance, research collaboration, or the development of cutting-edge issues in related fields. Overall, this graph illustrates that the contribution of authors is uneven over time, but rather dominated by a combination of authors with long-term involvement and authors whose productivity increases significantly in a given period, which together shape the dynamics of the development of the scientific literature.

Countries' Production over Time

The following is the data on Countries' Production over Time. The data can be seen in the graph below.

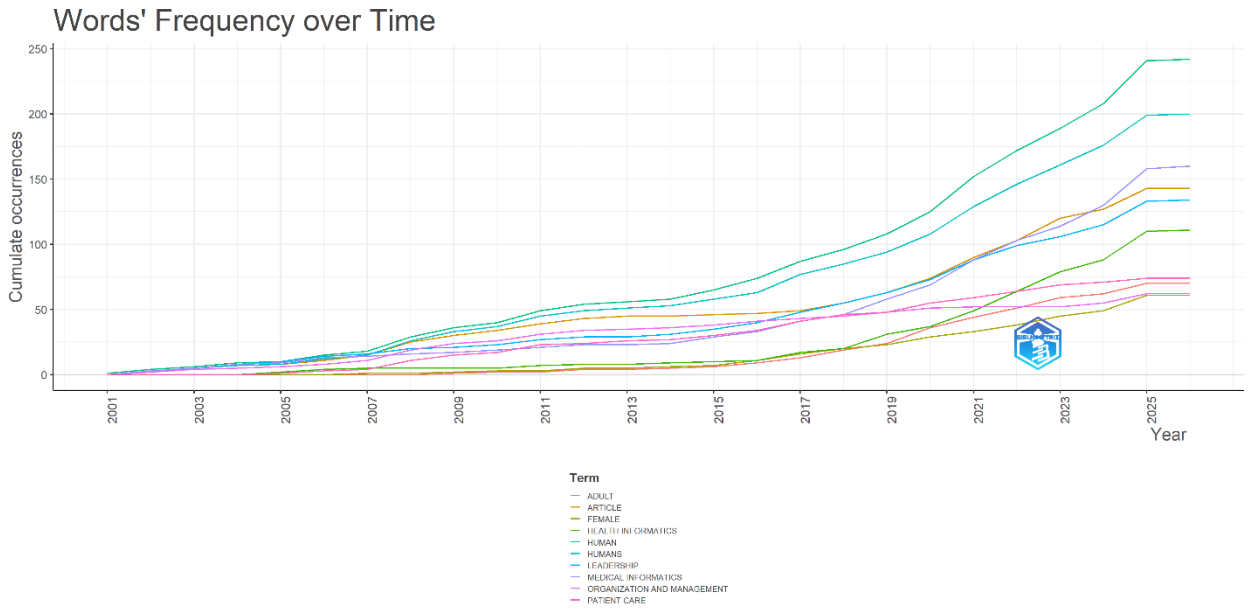

Image 10 Grafik Countries' Production over Time

The figure shows the trend of the cumulative frequency of keyword occurrence in the period around 2001–2025. In general, the entire term has gradually increased over time, which indicates that these topics are increasingly being discussed in scientific publications. In the early period (2001–2006), the increase was still relatively slow and even, indicating the early phase of the study's development. Entering the period 2007-2014, there was a more consistent increase, especially in the terms humans, medical informatics, and health informatics, which indicated that attention to the human aspect and the use of information technology in the health sector began to strengthen. After 2015, the increase in frequency became much sharper, particularly in terms of humans showing the most significant spike to reach the highest cumulative value at the end of the period. The terms medical informatics and health informatics also experienced rapid growth after 2018, reflecting the rapid development of digital transformation and technology integration in healthcare. Meanwhile, terms such as patient care, organization and management, and leadership show more moderate but stable growth, which indicates continued attention to managerial and service aspects. Overall, this graph illustrates the shift and strengthening of research focus over time, with a strong tendency towards human-based and information technology approaches in the context of health and management.

Most global Cited dokumens

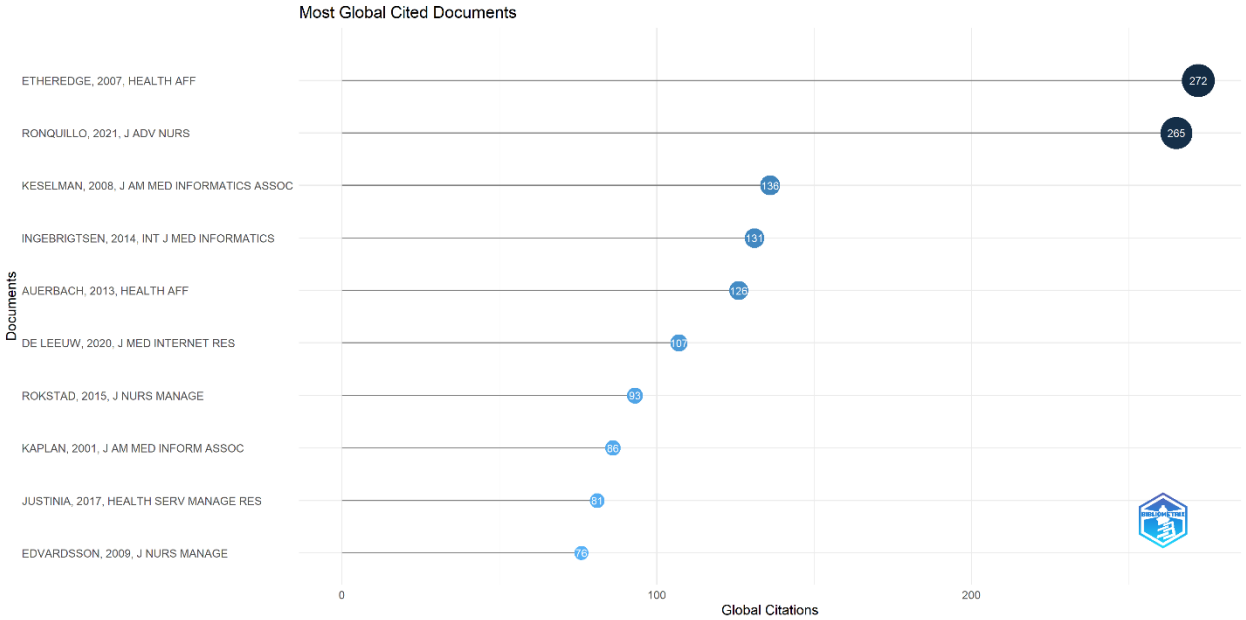

Image 11 Most global Cited dokumens

The image displays the documents with the highest global citations in the field of study analyzed. It can be seen that Etheredge's (2007) article in Health Affairs occupies the top position with the highest number of citations (272 citations), followed by Ronquillo (2021) in the Journal of Advanced Nursing with 265 citations. This shows that both publications have a very strong and far-reaching influence in the international scientific community. Other documents such as Keselman (2008) and Ingbertsen (2014) also show a high rate of citations (above 130 citations), which signifies an important contribution to the development of concepts and practices in the field of health informatics and healthcare management.

Furthermore, publications from Auerbach (2013) and De Leeuw (2020) show medium to high citations, reflecting the relevance of the topics discussed, especially related to health policy, medical internet research, and modern health service management. Meanwhile, documents with a lower but still significant number of citations such as the work of Kaplan (2001), Justinia (2017), and Edvardsson (2009) demonstrate fundamental and sustained contributions in the field of nursing management and medical informatics. Overall, this graph indicates that the most cited papers come from reputable journals and address strategic themes such as health informatics, service management, and leadership, thus serving as a key reference in future research.

Overlay visualization.

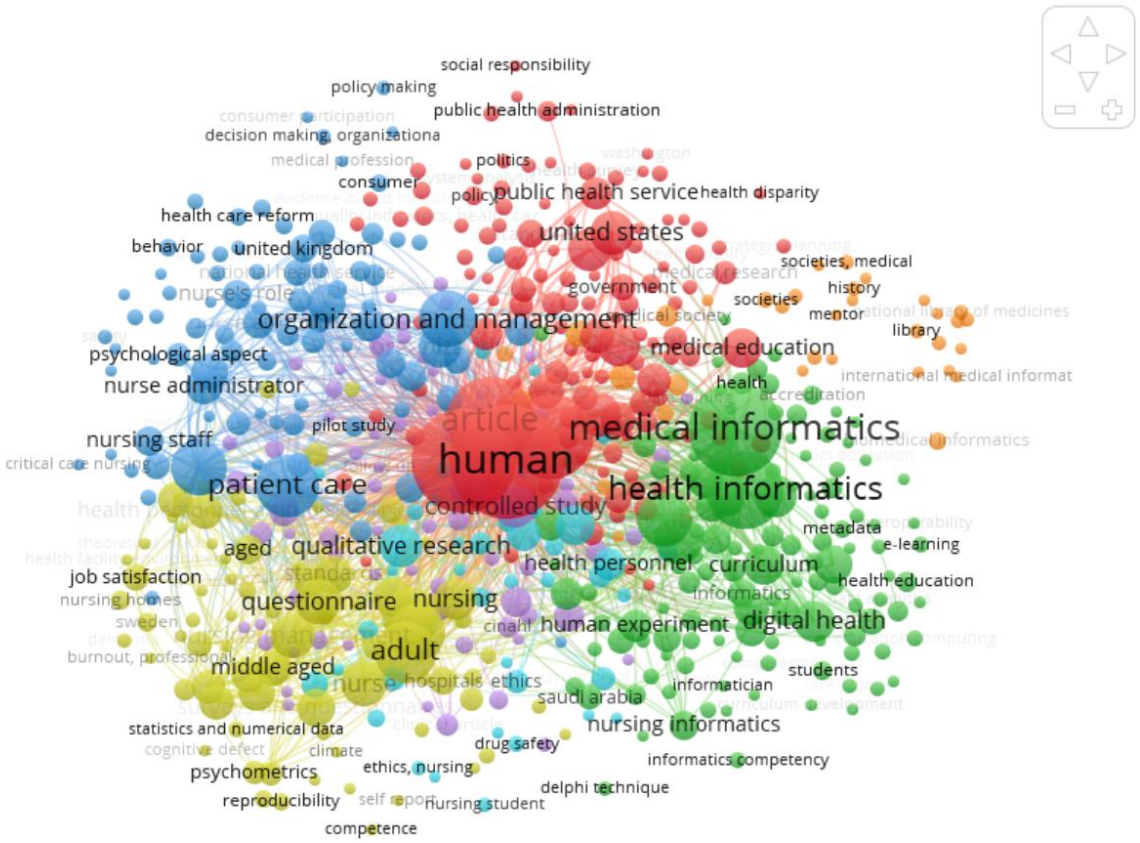

Image 12 Network map

Figure 14 above is a *keyword co-occurrence network map* that shows the structure and relationship of research themes in the fields of *medical informatics* and *health informatics*. The size of the node represents the frequency with which the keyword appears, while the color indicates clusters of interrelated topics. The keywords "human" and "medical informatics" appear to be at the center of the network with the largest size, indicating their dominant role and function as the main link between clusters. The red cluster contains many themes of *public health*, *medical education*, *health services*, as well as regional contexts such as *the United States*, which shows the focus of research on health services, public policy, and medical education in the modern health system. Meanwhile, the green cluster highlights the theme *of health informatics*, *digital health*, *nursing informatics*, and *health education*, which indicates increasing attention to the use of digital technology in health practice and education. The blue and yellow clusters show the relationship between *organization and management*, *patient care*, *nursing*, *questionnaire*, and *qualitative research*, which emphasizes the importance of organizational management aspects, patient care, and survey-based and qualitative methodological approaches. Overall, this visualization shows that research in the field of *medical informatics* is multidisciplinary, with strong integration between technology, human, healthcare, education, and management aspects.

Network Visualization.

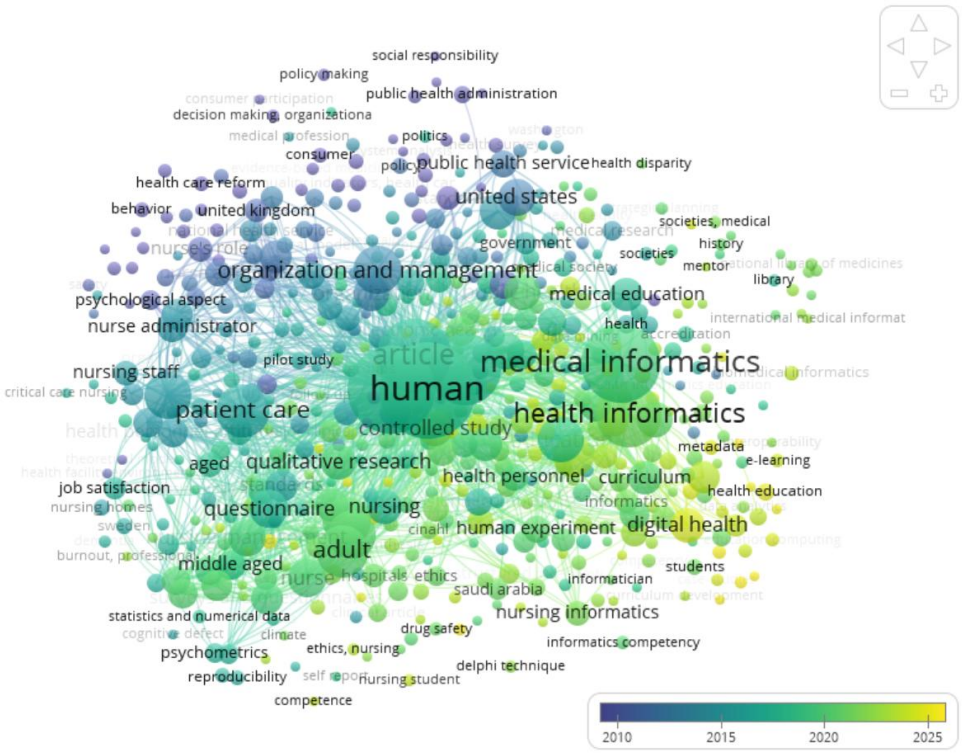

Image 13 Network visualization

Figure 15 above is a *keyword co-occurrence network* map equipped with *an overlay visualization* based on the time of publication (2010–2025), where the node size shows the frequency of keyword occurrences, the distance between nodes represents the strength of the linkage, and the color gradation depicts the temporal development of the research topic. The keywords "human", "medical informatics", and "health informatics" appear to be the most dominant nodes and are at the center of the network, indicating that the human aspect and health informatics are the main focus and cross-thematic link in the research. The cluster containing *organization and management*, *patient care*, *nursing*, and *public health service* shows the close relationship between health information technology and health service management and nursing practice.

Based on color gradient, darker topics tend to represent earlier research, such as *organization and management*, *patient care*, and *public health*, while lighter colors indicate more recent developing topics, such as *digital health*, *health education*, *e-learning*, and *informatics competency*. This shows a shift in research focus from managerial aspects and conventional health services towards the use of digital technology in education, improving the competence of health workers, and informatics-based learning systems. Overall, this visualization confirms that the field of *medical informatics* is developing dynamically and multidisciplinary, with research trends increasingly emphasizing the integration of digital technology, strengthening the role of humans, and improving the quality of health services and education.

Kajian SLR.

Of the 323 data obtained, 215 will be focused on the type of article.

Yes	Type	Quantity
1	**Article**	**215**
2	Conference Paper	36
3	Review	72
Total		323

Results of the prism method

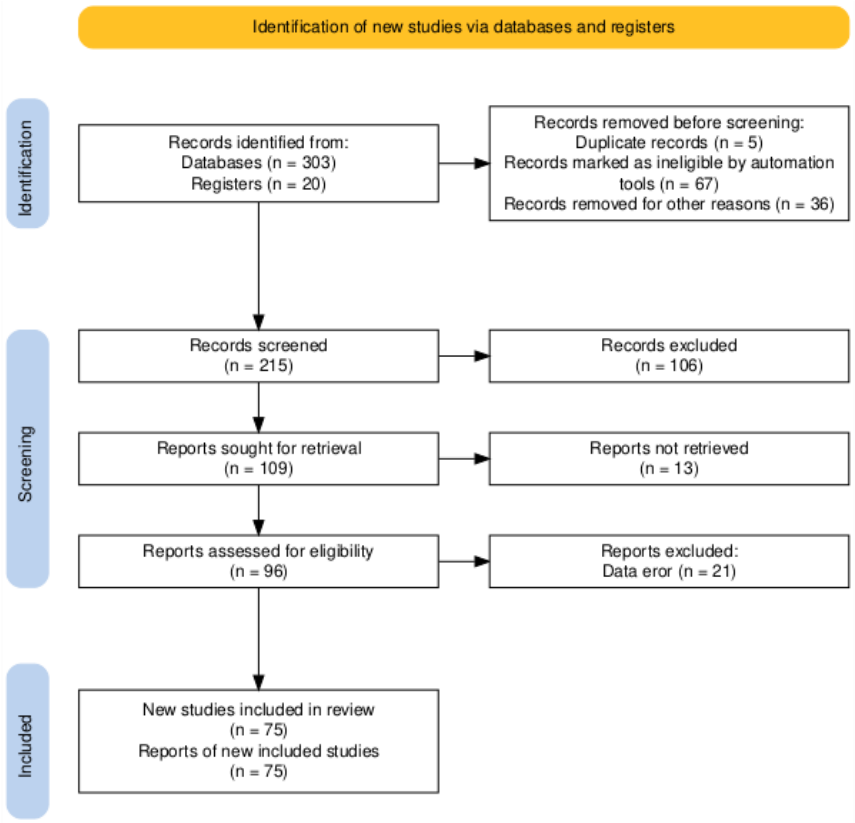

Image 14 Results of the Prism Method

In Figure 16 above, the process of selecting articles in a systematic review is carried out with reference to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. This selection process is visualized in detail through the PRISMA flowchart and consists of four main stages, namely identification, screening, eligibility, and inclusion. Each stage is carried out systematically to ensure that the selected study is truly relevant and meets the research criteria. At the identification stage, the researcher obtained a total of 323 records sourced from two main sources, namely 303 from Scopus and 20 articles from scholars. Furthermore, an initial deletion process is carried out for data that does not meet the basic criteria. A total of 108 data were removed before the screening stage, consisting of 5 duplicate data, 67 data that were declared unsuitable based on the automatic selection tool, and 36 data that were deleted for other reasons, such as topic mismatches or incomplete information. Thus, as many as 215 data were continued to the screening stage.

The screening stage was carried out by examining the titles and abstracts of the remaining 215 data. At this stage, as many as 106 data were excluded because they did not match the inclusion criteria that had been set, such as differences in research focus, irrelevant methods, or inappropriate research context. The results of this filtering process resulted in 109 data that were then searched to obtain the full-text. At the feasibility assessment stage, out of 109 data sought, as many as 13 reports were not successfully obtained so they could not be further analyzed. Thus, only 96 data can be assessed for thorough feasibility. Of these, 21 data were issued due to data errors that have the potential to affect the validity of the study results. In the final stage, 75 studies were declared to meet all inclusion criteria and were formally included in this systematic review for further analysis.
Overall, this selection process showed that out of a total of 323 initial records, as many as 75 studies or about 27.6% managed to pass the final stage. This reflects the implementation of a rigorous, systematic, and criterion-based selection process that is objective and structured in accordance with the PRISMA guidelines. Furthermore, the classification of research methodology is carried out based on the type of research, namely quantitative, experimental, observational, qualitative, conceptual,

mixed methods, and systematic review, which is presented in the form of the number of articles and percentages in the following table.

Table 4 Classification of types of research methods

Category	Number of Papers	Percentage	Characteristics & Examples
Quantitative	48	64.0%	- Using numerical data, statistical analysis, and computational models.- Examples: Research with machine learning, statistical analysis, or controlled experiments.
Experimental	16	21.3%	- Controlled design with intervention or treatment.- Example: Trial of AI models on specific datasets, laboratory experiments.
Observational	13	17.3%	- Observation without intervention, retrospective/prospective analysis.- Example: Clinical case study, secondary data analysis.
Qualitative	5	6.7%	- Interviews, content analysis, or phenomenological studies.- Examples: Studies of user perceptions of technology.
Campuran (Mixed Methods)	4	5.3%	- A combination of quantitative and qualitative approaches.- Examples: Surveys + interviews, or statistical analysis + case studies.
Systematic Review	6	8.0%	- Synthesis of literature with a structured methodology (PRISMA).- Example: Review of AI in education.
Conceptual	3	4.0%	- Theories, models, or frameworks without empirical data.- Example: A proposal for a new system architecture.
Total	**75**	**100.0%**	

Based on Table 4, the classification of research methodologies shows that Quantitative Research dominates (64.0%) due to trends in the use of data, statistics, and algorithms such as *machine learning*. Experimental research (21.3%) is commonly found in the medical and educational fields because of its focus on controlled trials, while Observational research (17.3%) is more commonly used for retrospective studies without intervention. Qualitative Research (6.7%) is used to explore perceptions or behaviors, and Mixed Methods (5.3%) combine numerical and narrative data to gain more comprehensive insights. Systematic reviews (8.0%) were conducted to synthesize the literature and identify trends, while Conceptual research (4.0%) was theoretical in nature with no empirical data. Overall, the dominance of quantitative approaches reflects the trend of data-driven research and artificial intelligence (*AI),* while other approaches remain important for social, pedagogical contexts, and theoretical development. The following is a classification of Main *Findings* based on the category of main findings, the number of *papers*, and the percentage.

Table 5 Main Findings Classification

Key Findings Categories	Number of Papers	Percentage	Characteristics & Examples
Model Performance Validation & Improvement	30	40.0%	- Demonstrate the superior effectiveness, accuracy, or efficiency of a proposed model or method.- Example: "A new neural network architecture achieves a classification accuracy of 98.5% on the XYZ dataset, outperforming the baseline model."
Identify Key Relationships or Factors	18	24.0%	- Uncover significant correlations, predictors, or causal factors that affect the outcome of a phenomenon.- Example: "Studies found that the frequency of exercise (β=0.75, $p<0.01$) was the strongest predictor for skill improvement."
Development of Theoretical Frameworks/Models	10	13.3%	- Generate a new conceptual model, framework, or procedure to guide research or practice.- Example: "This research proposes an 'AI-Edu Framework' consisting of four stages for effective AI integration in the classroom."
Exploration of Perception & Experience (Qualitative)	8	10.7%	- Uncovering themes, understandings, or deep insights from a participant's perspective through narrative data.- Example: "Theme analysis uncovers three key dilemmas practitioners face: ethics, accountability, and digital fatigue."
Evidence Synthesis & Recommendations (Review)	6	8.0%	- Conclude the current state of the evidence from the literature and provide direction for future research or policy recommendations.- Example: "A systematic review concludes that the evidence for the effectiveness of gamification is strong, but longitudinal research is still scarce."
Phenomenon/Case Description (Observational)	3	4.0%	- Provide a comprehensive overview or detailed report on a specific situation, trend, or case.- Example: "This case study documents the implementation of blended learning systems in rural schools during the pandemic and its infrastructure challenges."
TOTAL	75	100.0%	

Based on Table 5 of the Main Findings Classification, it can be concluded that the main focus of the research lies in the validation and technical improvement aspects, where the majority of findings (40.0%) show the success of AI/ML-based models or methods in improving accuracy, efficiency, or performance compared to conventional approaches. The findings also reveal many relationships and determinants (24.0%), as well as propose new theoretical frameworks (13.3%), while qualitative approaches (10.7%) and systematic reviews (8.0%) provide in-depth insights and literature synthesis. Although dominated by quantitative evidence-based findings, observational

research (4.0%) still contributes to documenting specific cases. Overall, the findings reflect a strong trend in technology and data-driven research, with development space still open for implementation, long-term impact, and ethical and social studies. The following is the classification of study *design* based on the study design category, the number of papers, and the percentage:

Table 6 Classification Study design

Categories Study Design	Number of Papers	Percentage	Characteristics & Examples
Experimental	22	29.3%	- Using manipulated control groups and interventions to test cause and effect.- Example: Randomized controlled trials (RCTs) to compare the effectiveness of two AI-based learning methods.
Quasi-Eksperimental (Quasi-Experimental)	15	20.0%	- Similar to experimentation but without full randomization, often used in naturalistic settings.- Example: Comparing the results of a class using a new digital platform with a class using traditional methods at the same school.
Studi Kohort (Cohort Study)	10	13.3%	- Observe a group of subjects (cohorts) that have similar characteristics over a certain period of time to see the development of an outcome.- Example: Track the academic progress of students who are exposed to the smart tutor system during one school year.
Case-Control Study	8	10.7%	- Comparing the group that experienced the outcome (cases) with the group that did not (control) to track the cause.- Example: Comparing the history of use of AI diagnostic aids between patients with early diagnosis (cases) and patients with late diagnosis (controls).
Studi Cross-Sectional	12	16.0%	- Collect data from a population at a single point in time to describe prevalence or relationships.- Example: A national survey to find out teachers' perceptions of the integration of AI in the curriculum.
Studi Longitudinal	5	6.7%	- Observe the same subject or phenomenon over a long period of time.- Example: Measure the long-term impact of a VR training program on surgical skill retention every 6 months for 3 years.

Categories Study Design	Number of Papers	Percentage	Characteristics & Examples
Qualitative Studies (Specialized)	3	4.0%	- Focuses on the extraction of meaning, experience, and perspective through non-numerical methods.- Example: Phenomenological study to understand patients' experiences in interacting with mental health counseling chatbots.
TOTAL	75	100.0%	

Based on Table 6 of the Study Design Classification, the analysis shows that experimental and quasi-experimental approaches dominate (49.3%), which are generally used to test the effectiveness and cause-effect relationship of a new intervention or technology under controlled conditions. On the other hand, observational designs including cross-sectional, cohort, and case-control studies also had a significant portion (40.0%) with a focus on pattern analysis, relationships, or phenomena descriptions without intervention. Meanwhile, longitudinal (6.7%) and qualitative (4.0%) studies were seen to be less, indicating that research with a long-term approach and in-depth exploration of the subject's experience could still be improved. This pattern reflects the research focus on proving the effectiveness and mapping of phenomena, with room for future development on longitudinal studies, real implementation, and mixed approaches to enrich the evidence and practical relevance. The following is the classification of future research based on the recommendation category, the number of papers, and the percentage:

Table 7 Future Research Classification

Recommended Categories	Number of Papers	Percentage	Characteristics & Examples
External Validation & Replication	28	37.3%	- Suggest testing models or findings on a broader and diverse population, dataset, or context to ensure generalization.- Example: "Further research is needed to test these predictive models in multiethnic patient populations and in different hospitals."
Longitudinal Studies & Long-Term Impact	22	29.3%	- Advocate for research that observes the effects or outcomes of an intervention over a longer period of time.- Example: "A longitudinal study is needed to evaluate the ongoing impact of an AI training program on participants' career performance over the next 5 years."
Real-World Integration & Implementation	18	24.0%	- Focus on implementing solutions or models in practical settings, including operational challenges, user adoption, and system integration.- Example: "Future research needs to explore the implementation of these AI-based diagnostic tools in routine clinical workflows and measure their impact on staff efficiency."
Technical Development & Methodology	15	20.0%	- Recommend improvements to the technical aspects of the model, algorithm, or the design of the research itself.- Example: "Subsequent

Recommended Categories	Number of Papers	Percentage	Characteristics & Examples
			research could develop a more energy-efficient algorithm or design an experimental design with tighter blinding."
Ethical, Social, & Regulatory Studies	12	16.0%	- Highlight the need to examine the ethical implications, bias, equal access, regulatory compliance, and social impact of a technology or intervention.- Example: "It is important to investigate algorithmic bias in automated recruitment systems and propose an ethical audit framework that the industry can adopt."
Mixed-Methods Research	10	13.3%	- Advocate a combination of quantitative and qualitative approaches to gain a more holistic understanding.- Example: "Future studies may combine quantitative A/B testing with in-depth interviews to understand *why* an interface design is preferred by users."
Cost-Benefit & Sustainability Analysis	8	10.7%	- Emphasizing the importance of evaluating the economic, financial, and sustainability aspects of the proposed solution.- Example: "Cost-effectiveness evaluation and ROI analysis are required before the large-scale implementation of this educational platform in rural areas."
TOTAL (Note: Amount of >75 as one paper can give >1 recommendation)	113	~150%	

Based on Table 7 of the Future Research Classification, the analysis of future research recommendations shows that the main focus is on the aspects of validation, replication, and generalization (37.3%), where the majority of studies emphasize the importance of testing findings in a broader and diverse context to ensure reliability and more universal applicability. In addition, recommendations for longitudinal studies and long-term impact analysis (29.3%) as well as practical implementation in the real world (24.0%) affirm the need for research that does not only stop at proof-of-concept, but also evaluates the sustainability and integration of solutions in a real environment. Non-technical aspects such as ethical, social, and regulatory studies (16.0%) are also starting to receive significant attention, reflecting the growing awareness of the broader implications of technological innovation. Other recommendations include methodology development (20.0%), a blended research approach (13.3%), and cost-benefit and sustainability analysis (10.7%). Overall, these findings point to the need for more integrated, applicative, and responsive future research to ethical and social challenges, with an emphasis on replication, long-term studies, and evidence-based applications. The following is the classification of the Summary of the Discussion based on the discussion category, the number of papers, and the percentage:

Table 8 Klasifikasi Summary of the Discussion

Category Discusi	Number of Papers	Percentage	Characteristics & Examples
Interpretation of Key Findings	70	93.3%	- Explain the meaning, significance, and relationship of the findings to previous hypotheses or research.- Example: "The 94% accuracy rate achieved by the CNN model not only validates the proposed architecture, but also demonstrates superiority over traditional approaches to detecting medical anomalies."
Implicasi's theorem	25	33.3%	- Discuss how the findings enrich, expand, or question existing theories, models, or frameworks.- Example: "These results support the expansion of the Technology Acceptance Model (TAM) by adding the construct of 'algorithmic belief' as a key mediator between usability perception and usage intent."
Practical/Applicative Implications	55	73.3%	- Describe concrete recommendations for the application of the findings in professional practice, policy, product development, or curriculum.- Example: "Based on proven time efficiency, it is recommended that educational institutions adopt this automated grading system to reduce the administrative burden on lecturers and provide faster feedback to students."
Study Limitations	65	86.7%	- Critically acknowledge weaknesses in the design, methodology, sample, measuring tool, or context of the research that may affect the validity and generalization of the results.- Example: "The study is limited by the use of a single and relatively homogeneous dataset, so generalization of findings to other populations needs to be done with caution. In addition, the short study period does not allow for long-term impact analysis."
Recommendations for Future Research	75	100.0%	- Propose specific directions, topics, or methodologies for subsequent research, which are usually born out of the findings or limitations of this study.- Example: "Subsequent research needs to test this model in a multinational setting, conduct longitudinal studies to measure knowledge retention, and explore integration with supporting technologies such as IoT."
Synthesis & Key Conclusions	75	100.0%	- Summarize the most important points of the entire study and provide a clear closing statement about the core value or contribution

Category Discusi	Number of Papers	Percentage	Characteristics & Examples
			of the study.- Example: "In conclusion, this study successfully demonstrated the effectiveness of gamification-based interventions in increasing learning motivation. Despite the implementation challenges, this work provides a strong empirical foundation for pedagogical innovation in the digital age."
NOTE			*The percentage is calculated from a total of 75 papers. The number of papers per category can be more than 75 because one paper usually discusses several aspects of the discussion at once.*

Based on Table 8 of the Summary of the Discussion Classification, analysis of discussion patterns in the study showed that almost all studies (100%) included Synthesis & Key Conclusions and Recommendations for Future Research, confirming the importance of drawing clear conclusions and specific forward directions. Most studies (93.3%) also focused on Key Findings Interpretation, which generally addresses validating system performance through quantitative metrics such as accuracy, speed, or efficiency. In addition, Practical/Applicative Implications (73.3%) are quite dominant by emphasizing the value of applying findings and factors that affect technology adoption in the real world. Transparency to Study Limitations is also very high (86.7%), generally related to sample issues, data bias, or generalization limitations. However, Theoretical Implications (33.3%) were relatively less discussed, suggesting room to further enrich the discussion by linking findings to relevant theoretical frameworks. Overall, research discussions tend to be strong on the applicative aspects and methodological reflections, but can be improved with more in-depth discussions on socio-ethical impacts, cost-benefit analysis, and integration of findings in the development of theories in the field of science.

Implications

The findings of this systematic literature review have important implications for nursing management practice, education, and policy. From a managerial perspective, digital transformation requires nursing leaders to move beyond operational adoption of technology toward strategic integration that aligns digital systems with clinical workflows, patient safety, and organizational goals. Effective leadership is essential to ensure that technologies such as EHRs, telemedicine, and AI-supported decision systems enhance patient-centered care rather than increase administrative burden or contribute to alert fatigue. Nursing managers are therefore encouraged to strengthen change management strategies, promote continuous digital competency development among nurses, and establish governance mechanisms to address data quality, interoperability, and cybersecurity risks.

From an educational and professional development perspective, the findings imply the need to embed digital leadership, health informatics, and ethical use of technology into nursing management curricula and continuing professional education. Nurses at managerial and supervisory levels must be equipped not only with technical skills, but also with competencies in data-driven decision-making, interdisciplinary collaboration, and evaluation of digital innovations. At the policy level, this review highlights the importance of supportive institutional and national policies that facilitate sustainable digital transformation, including investment in infrastructure, standardized health information systems, and regulations that protect patient privacy while enabling innovation.

Research contribution

This study contributes to the body of knowledge by providing an integrated synthesis of digital transformation in nursing management through the combined perspectives of leadership, technology integration, and patient-centered care. Unlike previous studies that often examine these dimensions separately, this systematic literature review offers a holistic framework that illustrates how nursing leadership mediates the relationship between digital technologies and clinical as well as organizational outcomes. By mapping bibliometric trends and thematic networks, this research also clarifies the evolution of key concepts, dominant research clusters, and emerging themes in the field over more than two decades.
In addition, this study contributes methodologically by combining PRISMA-based systematic review with bibliometric analysis, enabling both depth and breadth in understanding the research landscape. The findings provide empirical grounding for future theoretical development in nursing management and digital health, particularly in relation to leadership roles, organizational readiness, and patient-centered outcomes. As such, this review serves as a reference point for researchers, educators, and policymakers seeking to design, implement, or evaluate digital transformation initiatives in nursing management contexts.

Limitations
Several limitations should be considered when interpreting the results of this study. First, the literature search was limited to the Scopus database and publications written in English, which may have excluded relevant studies indexed in other databases or published in other languages. Second, although the review covered a broad time span (2001–2025), the rapidly evolving nature of digital health technologies means that some recent innovations and implementations may not yet be fully represented or evaluated in the literature.
Third, the included studies were heterogeneous in terms of research design, context, and outcome measures, which limits the ability to draw causal conclusions or perform quantitative meta-analysis. Finally, the bibliometric analysis relies on citation-based indicators, which may favor older publications with longer citation windows and may not fully capture the practical impact of more recent studies. These limitations suggest that the findings should be interpreted as a comprehensive synthesis of trends and patterns rather than definitive evidence of effectiveness.

Suggestions
Future research is recommended to focus on longitudinal and multi-site studies that examine the long-term impact of digital transformation on nursing management performance, patient outcomes, and workforce well-being. Empirical studies that integrate quantitative outcomes with qualitative insights from nurse leaders and frontline staff would provide a more comprehensive understanding of implementation challenges and success factors. In addition, further research is needed to explore contextual differences across healthcare systems, particularly in low- and middle-income countries, where digital readiness and resource availability may differ significantly.
Moreover, future studies should address ethical, legal, and socio-cultural dimensions of digital transformation, including data governance, algorithmic bias, and equity in access to digital health services. The development and validation of conceptual models that link leadership styles, organizational culture, digital competency, and patient-centered care outcomes would also strengthen theoretical advancement in this field. Such research will be essential to support evidence-based and sustainable digital transformation in nursing management**.**

CONCLUSION

Based on a systematic review of the literature that has been conducted, it can be concluded that digital transformation in nursing management is a multidimensional phenomenon that requires synergistic integration between visionary leadership, appropriate technology adoption, and patient-centered approaches to care. The study reveals that nursing leadership plays a crucial role in directing digital strategies, facilitating organizational culture adaptation, and ensuring that technological innovations such as EHRs, telehealth, AI, and clinical decision support systems can be implemented effectively, safely, and in accordance with clinical needs. On the other hand, digital

technology has been proven to strengthen _patient-centered care_ through increased access, personalization of services, and patient involvement as active partners in the treatment process. However, challenges such as digital divides, data security, administrative burdens, and the need to improve nurses' digital competencies still need to be addressed holistically. The contribution of this research to future science lies in the provision of an integrative framework that connects the dimensions of leadership, technology, and clinical outcomes, so that it can be the foundation for the development of a more comprehensive, ethical, digital nursing management model.

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AUTHOR CONTRIBUTION STATEMENT

RAR conceptualized the study, designed the research framework, conducted the literature search and screening process, performed data analysis, and drafted the manuscript. MQR contributed to the development of the methodology, bibliometric analysis, interpretation of findings, and critical revision of the manuscript. Both authors reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

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