A Bibliometric Analysis of the Global Trend of Nursing Research on Information Technologies from Past to Present

Geçmişten Günümüze Bilişim Teknolojilerine Yönelik Hemşirelik Araştırmalarının Küresel Eğilimi: Bibliyometrik Bir Analiz

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ABSTRACT

Objective: The aim was to evaluate the global trend of nursing research on information technologies and to analyze conceptual areas of knowledge development in this field.

Methods: R software and VOSviewer were used for the quantitative evaluation and visualization of the knowledge areas of studies on the subject. The literature from 1970 to the present day has been searched with the keywords "informatics" or "information technology" and "nursing" or "telenursing" or "telehealth nursing" or "telephone nursing" or "e-health nursing" or "telehealth in nursing" or "nursing informatics. Studies were evaluated by statistical and text mining analysis methods.

Results: A total of 5184 documents published between 1989 and 2023 were analyzed. Annual growth percentage is 4.31, and the international co-authorships percentage is 11.63. Number of keywords plus is 2739, and number of author's keywords is 6365. It revealed that key and reference articles focused on analysis of keywords and the impact of information technologies on nursing care. Telenursing with e-health, telehealth, telemedicine, and other information systems have been important topics for nursing informatics research. Two conceptual clusters are formed. First cluster includes nursing documentation, mobile health, e-health, long-term care, nursing education, educational technology, evidence-based practice, and quality improvement. The other cluster includes informatics competence, simulation, and curriculum in the training center. It is found that research on the subject is still not addressed in many developing or underdeveloped countries.

Conclusion: Nursing informatics research covers a wide spectrum in topics such as e-health and telehealth, while it is observed that the geographical distribution of these studies is uneven globally, with particularly less focus in developing or less developed countries.

Keywords: Medical informatics, information technologies, nursing informatics, health information, bibliometrics

ÖZ

Amaç: Bilişim teknolojilerine yönelik hemşirelik araştırmalarının küresel eğilimini değerlendirmek ve bu alandaki bilgi gelişiminin kavramsal alanlarını analiz etmektir.

Yöntemler: Konu ile ilgili araştırmaların bilgi alanlarının nicel değerlendirilmesi ve görselleştirmeleri için R yazılımı ve VOSviewer kullanıldı. 1970 yılından itibaren günümüze kadar olan literatür; "bilişim" veya "bilgi teknolojisi" ve "hemşirelik" veya "uzaktan hemşirelik" veya "tele sağlık hemşireliği" veya "telefon hemşireliği" veya "e-sağlık hemşireliği" veya "hemşirelikte tele sağlık" veya "hemşirelik bilişimi" anahtar kelimeleri ile taranmıştır. Araştırmalar istatistiksel ve metin madenciliği analiz yöntemleriyle değerlendirildi.

Bulgular: 1989 ile 2023 yılları arasında yayınlanan 5184 doküman analiz edildi. Yıllık büyüme yüzdesi 4,31, Uluslararası ortak yazarlık yüzdesi 11,63'tür. Anahtar kelime artı sayısı 2739, yazara ait anahtar kelime sayısı ise 6365'tir. Anahtar kelime analizine ve bilgi teknolojilerinin hemşirelik bakımına etkisine odaklanan anahtar ve referans makaleler ortaya çıkmıştır. E-sağlık, tele-sağlık,

teletıp ve diğer bilgi sistemleri ile tele-hemşirelik, hemşirelik bilişim araştırmaları için önemli konular olmuştur. İki kavramsal küme oluşmuştur. İlk küme, hemşirelik dokümantasyonu, mobil sağlık, e-sağlık, uzun süreli bakım, hemşirelik eğitimi, eğitim teknolojisi, kanıta dayalı uygulama, kalite geliştirmeyi içermektedir. Diğer küme ise, eğitim merkezinde bilişim yeterliliği, simülasyon ve müfredatı içermektedir. Konuyla ilgili araştırmaların birçok gelişmekte olan veya az gelişmiş ülkede hala ele alınmadığını tespit etti.

Sonuç: Hemşirelik bilişim araştırmaları, e-sağlık ve tele-sağlık gibi konularda geniş bir yelpazeyi kapsarken, bu araştırmaların coğrafi dağılımının dünya genelinde eşitsiz olduğu ve özellikle gelişmekte olan veya az gelişmiş ülkelerde daha az ele alındığı görülmektedir.

Anahtar Kelimeler: Tıp bilişimi, bilgi teknolojileri, hemşirelik bilişimi, sağlık bilgisi, bibliyometri

INTRODUCTION

Nurses, who play an important role in the health-care industry, comprise the largest group of health-care teams that determine and directly address patients' needs. Nurses are therefore among the first users of informatics. The ability of nurses to provide safe, quality patient care depends on their informatics readiness, and therefore it is vital to assess nurses' informatics competency.[1] As information and communication technologies continue to transform health care, scientists are increasingly seeking to understand their impact on patient care, education, and practice of health-care professionals.[2] The first informatics studies in nursing were created in 1974 by the International Medical Informatics Association. Nursing informatics was defined in the early 1980s as "the application of computer technology to all areas of nursing, nursing services, nursing education, and nursing research." In 1992, the American Nurses Association recognized nursing informatics as a specialty, and determined its standards of practice in 1995.[3] It has come a long way in nursing informatics since the 1980s. Good practice examples can also be seen at the point reached at the end of this long road. Institutions that provide care services, for example, previously only used information technology in financial and auxiliary department systems, but they have recently begun to apply and use it in clinical systems. Furthermore, at least 1 of the informatics subjects is taught as a course in the majority of nursing schools.[4] Researchers now have new approaches to interact with individuals and populations thanks to the growing use of informatics. Examples include the proactive use of communications technology to support the wellbeing of individuals and the use of mobile technology to manage some chronic conditions and support individuals living alone.[5] Furthermore, the recent growing adoption of electronic medical records and other digitized record systems has opened up entirely new areas of research for nurses. However, nurses working in various parts of the world are not sufficiently informed about nursing informatics research. At the same time, there are significant gaps/differences in the use of informatics in nursing and research on this topic between countries. Bibliometric studies examine publication models and trends, characterize concept developments, emerging new study topics, research gaps, information about existing literature, and current developments, and their characteristics.[6]

AIM

This study aims to highlight this gap using bibliometric analysis.

Research Questions

We will attempt to answer the following research questions about nursing research conducted within the scope of informatics using bibliometry

1. How is the development and trend of nursing informatics documents?

2. How is the distribution of nursing research on informatics by country and journal?

METHODS

Data Sources and Literature Search

First, the Web of Science was used to find studies that were relevant to the research question. Grant and Booth (2009)[7] proposed that literature reviews should follow the search, appraisal, synthesis, and analysis (SALSA) framework to ensure replicability, systematization, methodological accuracy, and comprehensiveness. According to the SALSA framework:

- TOPIC: ("informatics" and "information technology" and "nursing" or "telenursing" or "telehealth nursing" or "telephone nursing" or "e-health nursing" or "telehealth in nursing," or "nursing informatics")
- Refined by: Web Of Science Categories: (Nursing)
- And Languages: (English)
- And Document Types: (articles, proceeding paper review, book chapters, early access)
- TIMESPAN: 1970-2023 (Figure 1)

Study Selection and Extraction

The software Note Express was used to record and manage the output of the search strategy. Duplicate articles were deleted and research selection began. Inclusion criteria: (1) literature published between January 1, 1970, and January 31, 2023 (2) studies on "informatics" or "information technology" and "nursing" or "telenursing" or "telehealth nursing" or "telephone nursing" or "e-health nursing" or "telehealth in nursing" or "nursing informatics." (3) articles in English language. Exclusion criteria: (1) non-keyword documents (2) literature without the field of nursing (3) commentaries, editorials, and letters (4) elimination of duplicate literature. Once the final list of included studies was determined, all contents of these studies were retrieved from the WOS database in BibTeX file format (Figure 1).

Statistical Analysis

A descriptive bibliometric analysis of informatics applications in nursing was conducted. VOSviewer and the bibliometric R package (R version 4.0.5) were used to conduct the analyses. Authors' average citation frequency, keywords, and cross-national collaboration were all analyzed, clustered, and visualized using VOSviewer.[8] Biblioshiny is a useful tool for demonstrating scientific collaborations, general statistics, and relationships between units.[9] It works with the data of WoS, Scopus, and Dimensions and analyses in 7 categories: These are Conceptual Structures, Intellectual Structure and Social Structure, Overview, Authors, Sources, and Documents.[10] Conceptual structure refers to the basic themes discussed and followed by science. All bibliographic data were taken from the database WoS in the file format BibTeX.
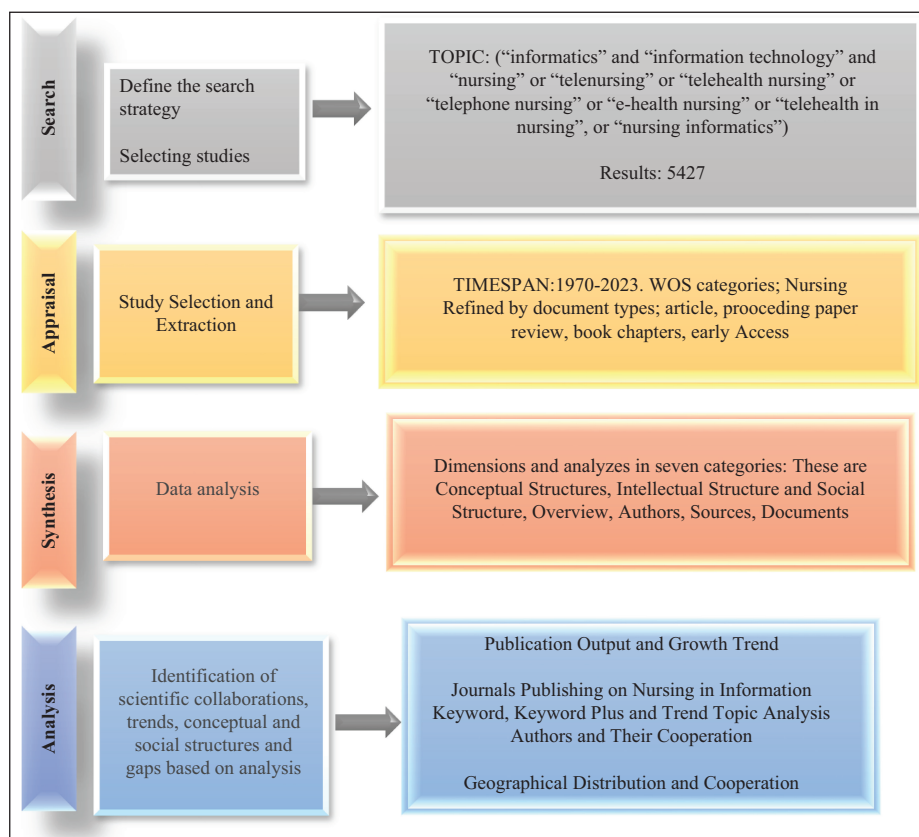
Figure 1. Search, appraisal, synthesis, analysis (SALSA).

First, the bibliometrix R package was downloaded and installed using R Studio. The biblioshiny application then started by typing "biblioshiny" into the R console. The Biblioshiny interface was used to upload the WoS files of the obtained publications in BibTeX format. In the analyses, author keyword collaboration was visualized using VOSviewer. R Studio was employed to examine Publication Output and Growth Trends, Journals Publishing on Nursing Information, Keyword Plus, and Trend Topic Analysis, Authors and Their Cooperation, Geographical Distribution and Cooperation, and the analyses based on Lotka's and Bradford's laws. Bradford's law describes the distribution ratio of scientific literature of any subject to journals. Analyses of this law show bibliometric laws such as half-life, literature aging, and impact factor.[11] WoS records contain 2 types of keywords: author keywords, which are given by the original authors, and keywords plus, which are words taken from the titles of references cited by Thomson Reuters. Keyword plus words or phrases are words or phrases generated by a computer algorithm that frequently appear in the titles of an article''s references but do not appear in the article's title or as author keywords.[13]

Total citation (TC) is the total number of citations reported for a single author or the average number of citations per article.[14] The h-index, developed by J. E. Hirsch, is calculated according to the number of publications and citations of the authors and objectively reveals the productivity of the researcher. This index is based on a list of publications in descending order of citation count.[15] Developed by Leo Egghe, the g-index is an alternative to the h-index that does not take average citation counts to measure the global citation performance of a series of articles.

The index is calculated based on the distribution of citations received by a particular researcher's publications. The g-index gives more weight to highly cited articles, while the h-index is insensitive to it.[16] Because young researchers have fewer academic years to cite their papers, the h-index is a less appropriate measure for them. Dividing the h-index by the number of years active in academia can facilitate comparison between academics with different academic career years. In this way, the m-index is obtained.[17]

Ethical Considerations
Ethical review is not required as this study examines the literature published in databases.

RESULTS

In total, 5184 documents were analyzed. The total number of authors is 11 541, and the total number of single-authored studies is 534. The annual growth percentage is 4.31, and the international co-authorship percentage is 11.63. The number of keywords plus is 2739, and the number of author's keywords is 6365 (Table 1).

Publication Output and Growth Trends
The first articles were published in 1989 (5 publications). Especially in 1994, the number of them increased significantly (n = 245). After 2006, the number of publications grew year after year, and most publications were made in 2016 (n = 576) (Table 2).

Journals Publishing on Nursing Information
By Bradford's law, journals that publish on a particular subject are divided into regions with an equal number of articles, and these journals are ranked in decreasing efficiency. Region 1 contains the

Table 1. Main Statistics on The Nursing İnformation Technology Literature

Description	Results
Main information about data	
Time span	1989-2023
Sources (journals, books, etc)	851
Documents 5184	5184
Annual growth rate %	4.31
Document average age	11
Average citations per doc	9.133
Document Types	
Article	2314
Article; book chapter	137
Article; early access	22
Article; proceedings paper	72
Editorial material	245
Meeting abstract	104
Proceedings paper	2019
Review	271
Document contents	
Keywords plus (ID)	2739
Author's keywords	6365
Authors	
Authors	11541
Authors of single-authored docs	534
Documents per author	0.255
Authors per document	3.92
International co-authorships %	11.63

Table 2. The Number of Publications and Total Citations Related to The Nursing Information Technology Literature

Year	Articles	Mean TC per Art	Mean TC per Year
1989	5	3.2	0.09
1992	14	1.14	0.04
1993	4	5	0.1
1994	**245**	**0.71**	**0.0**
1995	13	8.92	0.3
1996	6	6.83	0.3
1997	182	1.3	0.5
1998	37	19.2	0.9
1999	20	7.65	0.4
2000	18	9.8	0.4
2001	33	25.12	1.1
2002	29	30.5	1.4
2003	51	44.9	3.4
2004	69	25.6	1.4
2005	63	31.2	1.8
2006	409	24.1	1.5
2007	90	30.5	2.3
2008	101	31.6	2.5
2009	370	25.6	1.9
2010	136	26.2	2.1
2011	233	26.5	2.4
2012	170	22.4	2.2
2013	175	18.8	2.0
2014	249	20.9	2.6
2015	240	13.9	1.9
2016	**576**	**13.6**	**2.2**
2017	235	9.8	1.9
2018	335	9.4	2.3
2019	260	6.61	1.6
2020	216	5.70	1.9
2021	271	0.71	0.7
2022	8	0.125	

TC, total citation.

most productive core group of journals that publish articles on the subject. Other regions include journals containing as many articles as the first region. In this way, it makes it possible to identify the most relevant sources according to the number of publications. The analysis based on Bradford's Law also explains these sources (Figure 2A).[12] When productive journals on nursing information technology were reviewed, *Nursing Informatics 2016: Ehealth For All: Every Level Collaboration From Project to Realization* (n = 379), and *Consumer-Centered Computer-Supported Care For Healthy People* (n = 358), *CIN: Computers Informatics Nursing* (n = 296), *Connecting Health and Humans* (n = 249), and *Nursing Informatics: An International Overview For Nursing in a Technological Era* (n = 230), *Nursing Informatics: The Impact of Nursing Knowledge On Health Care Informatics* (n = 162), and *International Journal of Medical Informatics* (n = 116) were identified as the most productive journals (Figure 2B).

Keyword, Keyword Plus, and Trend Topic Analysis
The analysis reveals that the idea of "nursing and information technologies" focuses primarily on the impact of nursing care and information technologies on care. The concepts of "quality and implementation of nursing practices, system and management" emerged because of these (Figure 3A). Authors' keywords and links investigated in VOSviewer, the frequency of use of keywords, their relationships, were indicated with box colors and font (Figure 3B). Following this image, the keywords "computer literacy, medical informatics application, clinical information

system, patient education" have emerged in the 2010s. When the clusters according to the colors are examined, the words information systems, nursing education, nursing informatics, software, mobile applications, intensive care units, distance education and learning, and emergency nursing are clustered within the framework of nursing. Within the scope of information technologies, health informatics, home health monitoring, e-health, geriatric medicine, coronavirus disease 2019 (COVID-19), and COVID-19 home health monitoring are clustered in the framework of oncology, pandemic, and remote monitoring. In the electronic health records cluster, nursing home, evaluation, nursing information systems, workflow, clinical decision support systems, and case management clusters are seen (Figure 3B).

This study can provide us with information on study areas, trends, and information that has developed from these trends
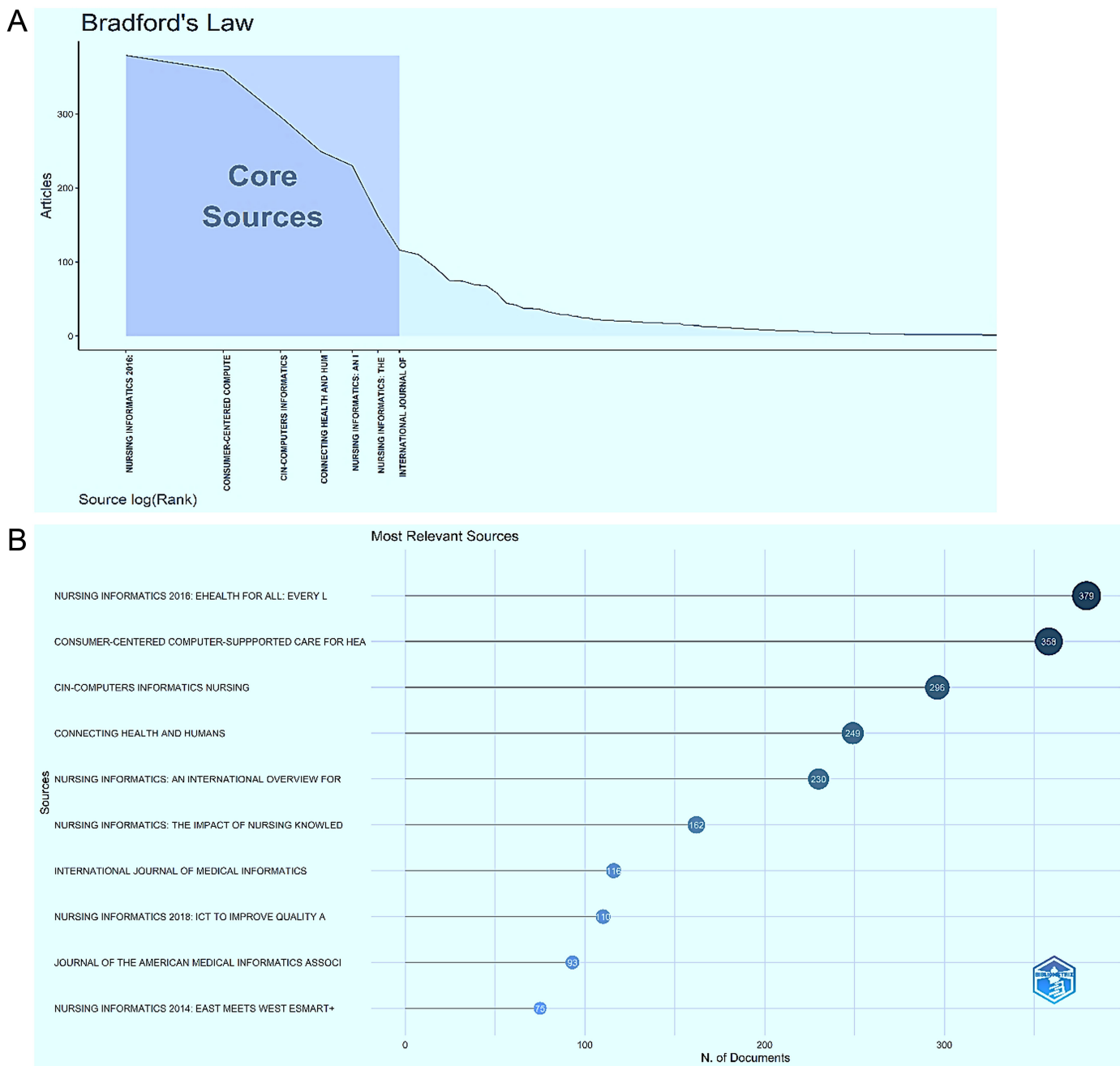
Figure 2. A. Bradford's law core sources. B. Most relevant sources.

over the years. According to the research, in keyword plus analysis the evolution of informatics concepts within the scope of nursing started to develop with system and system implementation from 2011 to 2015. Topics that were the most trending topics in the historical process studied from 2015 to 2017. These concepts focused on information technologies, impact, nurses, and care communication (Figure 3C). The most used keyword within the scope of nursing information technologies is information technology (n = 302, first and last publication year = 2010-2019) and it has been used since 2010 until today. Other keywords in order of use are health information technology (n = 186, first and last publication year = 2013-2019), telenursing (n = 181, first and last

publication year = 2014-2019), and telemedicine (n = 92, first and last publication year = 2014-2021). Keywords used to date are telemedicine, qualitative research, nursing homes, and electronic health records (Table 3).

Factor analysis was performed on keywords plus using multiple correspondence analysis. Two clusters emerged in the factor analysis of the conceptual structure of the keyword plus part of the studies on nursing informatics. The first cluster is quite large and comprehensive, and marked in red, developing within the scope of the structure and classification of nursing informatics technology, nursing documentation, mobile health, e-health, long-term care, nursing education, educational technology, evidence-based practice, and quality
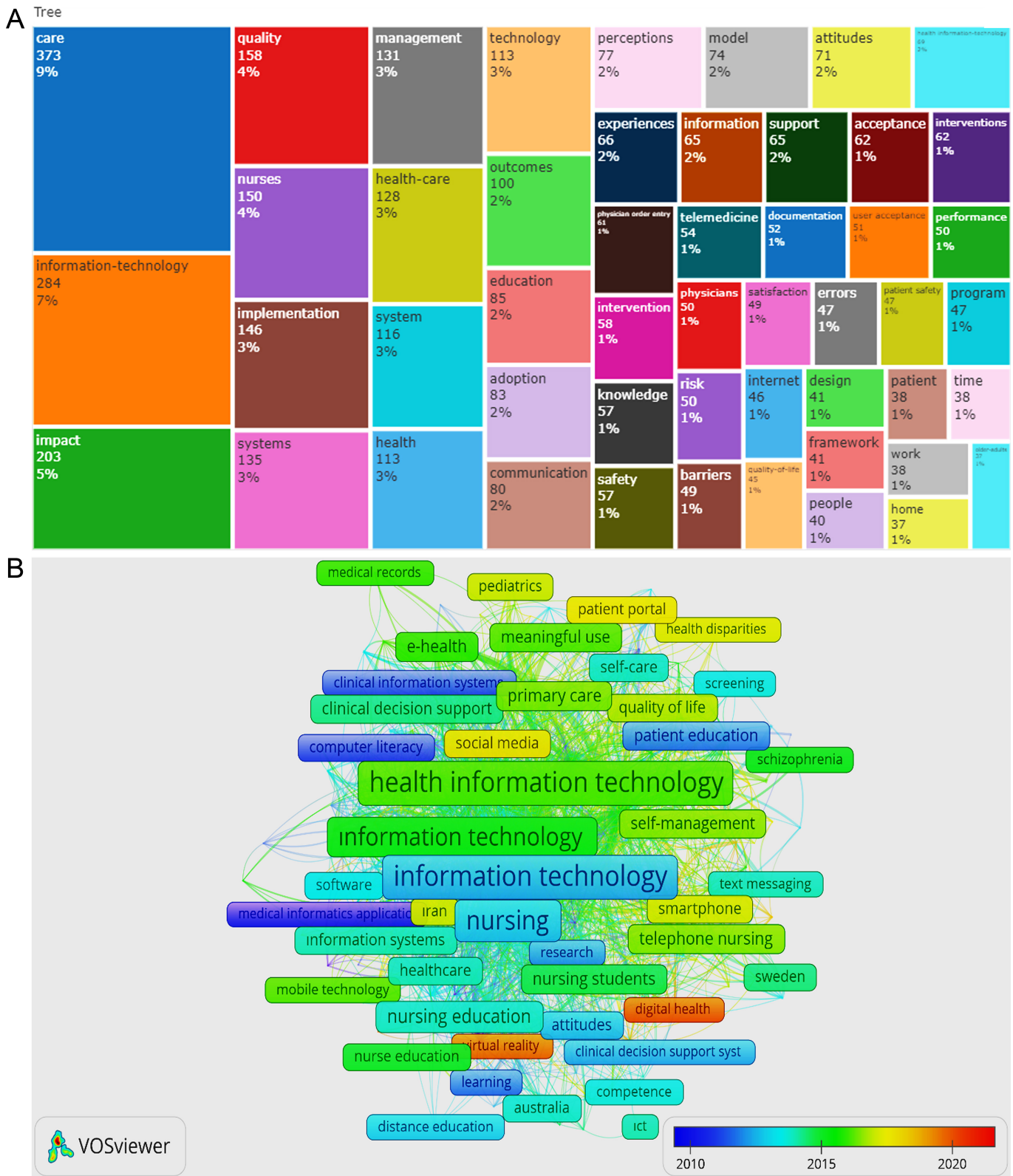
Figure 3. A. Keyword plus tree. B. Author keyword links. C. Trend topics of keyword plus. D. Keyword conceptual map structure of publications related to nursing information technology literature. (*Continued*)

improvement. The other cluster is shown in blue, focusing on simulation, informatics, competency, and curriculum (Figure 3D).

Authors and Their Cooperation

Table 4 shows the authors' h-index, g-index, m-index, TC, and publication year start findings. As a result, when the index

C   Trend Topics

D   Conceptual Structure Map - method: MCA

Figure 3. (*Continued*).

scores of the authors are evaluated in terms of all 3 indicators (h–g–m index), the 4 authors with the highest score in terms of h-index are Bakken S (n = 15), Alexander GL (n = 10), Valimaki M (n = 11), and Gagnon MP (n = 10). The 4 authors with the highest scores on the g-index are Bakken S (n = 30), Valımakı M (n = 17), Schnall R (n = 16), Alexander GL (n = 15) (Table 4). According to Lotka law, 60% of the authors working in any field should contribute to the field with 1 article; however, 15% of the authors should contribute with 2 articles and 7% with 3 articles.[18] When the authors and articles related to the research topic were reviewed according to Lotka's law, 85% consisted of authors with 1 article (n = 7721), 9.6% of authors with 2 articles (n = 870), and 2.6% of authors with 3 articles (n = 232) (Figure 4).

Table 3. Trend Topics Author Keyword

| Item	Frequency	Year_q1	Year_med	Year_q3
Information technology	302	2010	2015	2019
Health information technology	186	2013	2017	2019
Telenursing	181	2014	2017	2019
Telemedicine	92	2014	2018	2021
Nursing informatics	81	2010	2015	2018
Telehealth	82	2013	2016	2019
Patient safety	78	2011	2015	2019
Electronic health records	74	2014	2017	2020
Electronic health record	72	2013	2016	2018
Technology	67	2012	2016	2019
Nurses	55	2010	2013	2018
Communication	52	2013	2016	2019
Internet	51	2008	2011	2016
Informatics	41	2011	2015	2019
Nursing education	40	2014	2016	2017
Qualitative research	40	2014	2018	2020
Nursing homes	37	2013	2017	2020
Education	36	2010	2017	2018
Quality improvement	30	2016	2018	2019
Information systems	27	2010	2014	2018
Computers	23	2007	2009	2010
Patient education	21	2009	2012	2016
Self-care	18	2011	2013	2018
Clinical decision support	18	2013	2014	2018
Attitudes	16	2010	2014	2016
Medication errors	16	2009	2014	2019
Decision-making	14	2010	2013	2016
Hospitals	14	2009	2013	2017
Diabetes mellitus	13	2010	2013	2018
Telephone triage	11	2008	2010	2015
Learning	10	2009	2010	2017
Evaluation studies	10	2010	2012	2014
Chemotherapy	9	2008	2009	2011
Symptom management	9	2008	2010	2014
Computer literacy	9	2009	2011	2015
Aged	9	2011	2012	2017
Clinical information systems	8	2011	2011	2012
Education, nursing	8	2009	2011	2015
Chronic disease	8	2011	2012	2017
Discharge planning	7	2009	2012	2016
Questionnaire	7	2008	2010	2011
Triage	7	2008	2010	2017
Action research	6	2007	2011	2019
Distance learning	6	2008	2009	2014
Information literacy	6	2008	2008	2011
Personal digital assistant	6	2006	2007	2011
Decision support systems	5	2007	2008	2017
Medical errors	5	2006	2007	2017

Table 4. Most Relevant Authors And Authors Local İmpact

Authors	h- Index	g-Index	m-Index	Total Citation	Number of Documents	Start of Publication Year
Bakken S	15	30	0.682	918	30	2001
Alexander GL	10	15	0.625	249	22	2007
Kearney N	9	9	0.391	389	9	2000
Schnall R	9	16	0.750	409	16	2011
Valımakı M	11	17	0.688	290	17	2007
Gagnon MP	10	14	0.769	579	15	2009
Bowles KH	8	12	0.533	160	14	2008
Bates DW	8	11	0.421	348	11	2004
Kamınsky E	4	8	0.308	76	12	2009
Vawdrey DK	9	9	0.750	348	9	2011
Brennan PF	9	11	0.310	390	11	1994

The Frequency Distribution of Scientific Productivity
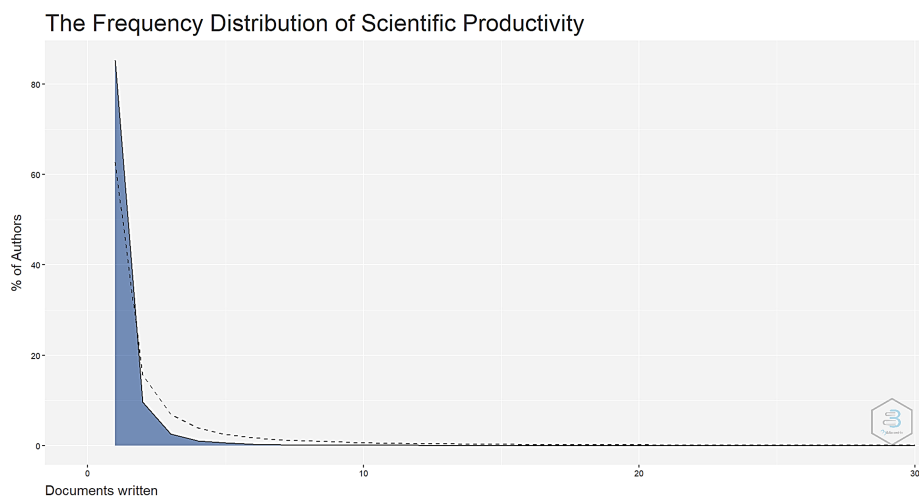
Figure 4. Author productivity through Lotka's law.

Country Collaboration Map
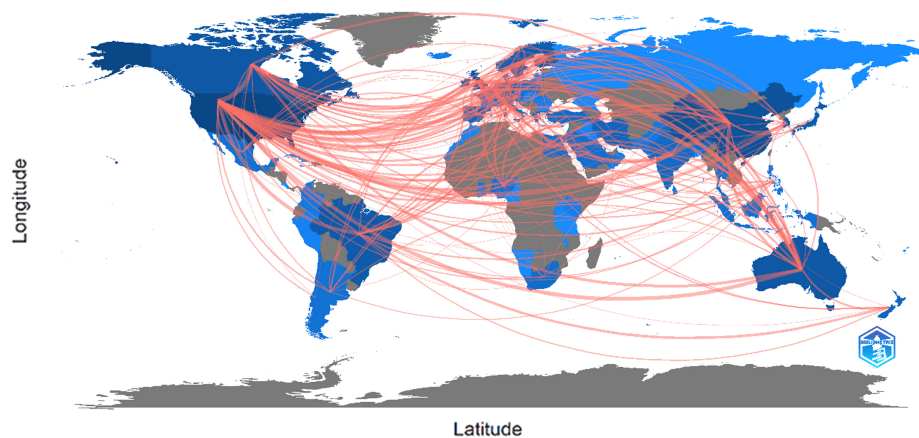
Figure 5. Country collaboration map.

Geographical Distribution and Cooperation

Looking at the number of releases by country, the top 10 broadcasting countries are the United States (5954), China (1294), Canada (833), Australia (682), the UK (517), Brazil (475), South Korea (470), Finland (412), Japan (393), and Sweden (342). Figure 4 depicts the historical and global collaboration of countries involved in the fields of information technology and nursing. The pink color on the map represents international research collaborations. It might range from a 1-time collaboration to ongoing collaboration between the 2 countries. The highest level of cooperation was

discovered to be between the United States and Canada, while other significant collaborations included the United States and the UK, the United States and China, and the United States and Korea (Figure 5).

DISCUSSION

A bibliometric analysis of 5184 nursing information technology documents published between 1989 and 2023 was conducted in this study. It can be seen that the first studies on nursing informatics were done in 1989. The pace of rising in the number of articles was observed to peak in 2011 and 2015. It can be seen that the definition of nursing informatics as a field by the American Nurses Association in 1994 and the implementation standards in 1995 had a positive effect on the increase of studies on the topic, which continued in the following years. The year 2016 is regarded as the year when most research was conducted in this area. As indicated in the International Nurses Council theme for 2021, technological interventions in nursing practice increased by approximately 50% during the COVID-19 epidemic, so the amount of research in this area has also increased. Requested health services are supplied, individuals are trained, counselling is provided to people in the high-risk group, and communication with patients with chronic diseases is maintained via nursing information applications.[19] Simultaneously, changes in patients' conditions are noticed early and early intervention is provided, allowing patients to take charge of their treatment and care, which helps them return to their daily roles.[20,21] As a result, in pandemic and similar situations, nursing informatics comes to the fore, and the need for this field grows.

The result of the author keywords, keyword plus study reveals that it concentrates on the impact of nursing care and information technology. E-health, telehealth, telemedicine, and telenursing with other information systems are emerging as important topics for nursing informatics research.[22,23] Given that patients of the future will be knowledgeable in many areas, new training curricula will prepare health-care workers for the issues that may arise as a result of technology.[24]

It was noted that the authors' keywords started with informatics, the internet, and computer and evolved into some specific areas including clinical decision-making system, patient safety, nursing education, and chronic diseases. It is critical for nurses to grasp the connections between their practices and informatics and to create systems in this area. In clinical practice, for example, they can aid in the development of technologies such as monitoring patient outcomes using computers, detecting data trends, tracking and contacting patients virtually, improving workflows, and assisting patients with sickness management.[25] During the COVID-19 epidemic, the use of information technologies in patients with chronic conditions (e.g., heart failure, diabetes) has become even more significant. Because this patient population had difficulty applying to health-care facilities due to infection from COVID-19, attempts were made to address this problem by monitoring patients remotely, and this was considered an alternative method during the epidemic.[26]

According to our research, the usage of information technologies in nursing education grew during the COVID-19 epidemic, and most nursing schools performed lessons remotely, either synchronously or asynchronously.[25] Because pandemics and other similar phenomena cannot be predicted, it is unavoidable to take advantage of information technologies and disseminate research on the subject. A study of the 50 countries most affected by COVID-19 found that interest in and demand for information technology have risen and that they will need to strengthen their information technology skills both during and after the pandemic.[24]

Determining how authors, institutions, and countries affect each other in bibliometrics constitutes the social structure. This structure shows the level of penetration of the authors into a scientific community. It has been understood that the distribution of authors in the research does not comply with Lotka's law. However, authors who have more than 5 publications (n = 77) should be considered as core authors, considering that they have deepened in the field of nursing information technology. In this context, there is a need to increase the publications and cooperation related to information technologies.

Nursing information research is geographically widespread. According to economic, research, and health-care development indices, the most productive countries are the leaders. The United States stands out as the most collaborative and productive country. However, it is also worth noting that the issue is still not being addressed in many developing or underdeveloped countries (most African countries). The lack of a national health information management strategy will always be a threat to health informatics performance in African countries.[27]

Findings of this study reveal that the use of technology in health care is expanding and that the rate of technology use by nurses is increasing in lockstep with this acceleration. Nurses are using technology in many areas, such as patient care, education, and counseling. Informatics competence has become a global imperative for nurses. The use of information technologies to improve the quality and efficiency of care has become essential for nurses and health systems administrators. Nurses, on the other hand, need to enhance their nursing informatics abilities as part of their professional education to adapt to quickly evolving technology. The current research directions and knowledge gaps revealed by this bibliometric analysis can serve as guidance for future studies.

The bibliometric analysis conducted here highlights the increasing prominence of applications such as e-health and telehealth, especially in circumstances like pandemics, where the need for patient monitoring and consultation become crucial. The evolution of technological applications towards these areas is crucial, especially considering the rising elderly and chronically ill population in communities. It is essential for determining the health data trends within the community. Additionally, the research into new technological methods geared towards undergraduate, graduate, and lifelong nursing education is promising. However, there are significant disparities between countries concerning research on this topic. To bridge these disparities, further endeavors are essential in numerous areas, such as enhancing a country's technological infrastructure and capacity, fostering international cooperation, and integrating the use of technology into educational curricula.

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