Original Article

Geriatric and Artificial Intelligence: Bibliometric Analysis

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Abstract
Introduction: According to the World Health Organization, by 2030, 1 in every 6 people worldwide will be aged 60 or older. This demographic shift is expected to lead to an increase in diverse and complex needs for healthcare services globally. Emerging technologies have been integrated into various healthcare areas, with elder care being one of the fields that has benefited the most. Artificial intelligence plays a critical role in managing multidimensional health data, particularly for elderly patients facing complex health issues.
Aim: This study aims to identify and visualize articles on artificial intelligence applications in the geriatric population, providing future researchers with a literature-based overview.
Materials and Methods: Data were retrieved from the "Web of Science Core Collection" database on August 7, 2023. For bibliometric data, a search was conducted in the WoS database using the keywords "geriatric" and "artificial intelligence," yielding a research population of 129. The number of publications by year, author, country, and keyword analysis was performed for the published articles.
Results: Analysis indicated that the most frequently used keywords in the Web of Science category were “artificial intelligence,” “geriatric,” “machine learning,” and “older adults.” On a country basis, the United States had the highest number of studies (n=21). Publication numbers have increased since 2019, with the highest number of publications in the last two years (2023–2024, n=23). The most common category for these studies in the Web of Science was "Geriatrics & Gerontology" (n=31).
Conclusion: The findings of this study are expected to contribute to the identification and evaluation of the current status of artificial intelligence in geriatrics, providing guidance for future research in this field.

Key Words: Geriatrics, artificial intelligence, bibliometric analysis

Introduction

The rapid increase in the elderly population worldwide brings unprecedented challenges. According to World Health Organization (WHO) data, the number of people aged 65 and older is projected to reach approximately 1.6 billion globally by 2050 (WHO, 2022). This rapid aging process places considerable pressure on societies and countries, affecting economies, labor structures, and social security systems (Skirbekk et al., 2019).

Artificial intelligence (AI) is a new field of study that develops theories, methods, technologies, and application systems aimed at simulating, extending, and popularizing human intelligence (Guo et al., 2022). One of AI's primary objectives is to enable machines to perform complex tasks that require human intelligence. AI offers various advantages, such as automatic data

extraction, time and labor savings, ease of use, and long-term sustainability. These benefits are utilized in healthcare for applications like disease prediction and management (Guo et al., 2022; Wang et al., 2018).

AI technologies assist physicians in diagnosis, determining treatment options, and predicting disease progression. By classifying and optimizing efficiency based on risk factors, AI contributes to addressing health issues related to geriatric diseases and is valuable for healthcare professionals and patients alike. AI algorithms can analyze extensive datasets, identifying patterns and trends that may be overlooked by clinicians (Noorbakhsh et al., 2019). This information strengthens clinical decision-making processes, allowing for more effective healthcare delivery. In recent years, the use of AI in geriatrics has significantly increased.

Geriatric individuals often contend with multiple chronic conditions. AI-powered products developed for each chronic disease offer substantial ease of use for elderly patients (Fong, 2019). In particular, the development of wearable devices in healthcare provides a potential solution for monitoring daily activities and fall incidents (Haenlein et al., 2019). These devices support independent living for the elderly by detecting falls and enabling prompt intervention (Koc, 2023).

Additionally, AI-powered robots provide mobility support for elderly individuals in rehabilitation processes. Exoskeletons and rehabilitation robots assist in physical therapy, encouraging exercise and helping elderly individuals improve their mobility and strength. By offering personalized assistance and feedback, these technologies enhance the elderly's independence and improve their quality of life (Koc, 2023).

Research shows that AI is used effectively in geriatric health. For example, a study by Kearney et al. (2021) examined the effectiveness of wearable devices (e.g., smartwatches) in identifying fall risks among elderly individuals. These devices monitored daily activities, detected fall events, and enabled early intervention through alerts. Similarly, research by Lee and Kim (2020) explored the impact of AI-powered robots on elderly individuals' physical rehabilitation. The study showed that robots could guide individuals during exercise, enhancing mobility (Lee and Kim, 2020). Zhang et al. (2022) evaluated AI algorithms in chronic disease management, showing that AI can analyze health data from elderly individuals to offer personalized treatment recommendations (Zhang et al., 2022).

Lastly, Al-Fuqaha et al. (2018) investigated the role of smart home systems in enhancing the quality of life for the elderly. These systems monitor daily activities and assist in emergencies (Al-Fuqaha et al., 2018).

Bibliometrics is a field that expresses the quantitative synthesis of publications through mathematical and statistical methods (Niu et al., 2016). This approach analyzes trends, distribution, and relationships within a field based on external features such as the number of publications, authors, and journals. This study used bibliometric methods to perform a comprehensive analysis of research on AI applications in geriatric care.

Materials and Methods

Objective: The aim of this study is to access studies related to geriatrics and artificial intelligence in the Web of Science (WoS) database, revealing international-level outcomes on this topic. The following questions were explored:

- In which categories are articles on geriatrics and artificial intelligence published?
- What is the distribution of articles on geriatrics and artificial intelligence over the past decade?
- How are articles on geriatrics and artificial intelligence distributed by author and country?

- In which journals are articles on geriatrics and artificial intelligence published?
- What are the most frequently used keywords in articles on geriatrics and artificial intelligence?

Method: Data were obtained on August 7, 2023, using the Web of Science Core Collection database, and a bibliometric analysis of authors, countries, and keywords was conducted through VOSviewer (1.6.15) using performance analysis and scientific mapping methods. The search yielded 129 studies using the keywords "geriatric" and "artificial intelligence," with all data included and no exclusion criteria applied.

Research Ethics: The study did not involve any interaction with humans or animals, nor was any primary data collected. The study used secondary data from the WoS database, and therefore, no ethical approval was required.

Results

When studies using the keywords "geriatric" and "artificial intelligence" were categorized in the Web of Science Core Collection database, the most frequent category was "Geriatrics & Gerontology" (n=31). Other categories included Gerontology (n=18), Medical Informatics (n=54), Health Care Sciences Services (n=13), Medicine General Internal (n=13), Health Policy Services (n=24), Psychiatry (n=11), Computer Science Information Systems (n=8), and Computer Science Artificial Intelligence (n=7), with other categories listed five times (Table 1).

When examining the document types of these publications, we observe that over half (64.341%) are articles, followed by editorial materials and early access publications (Table 2).

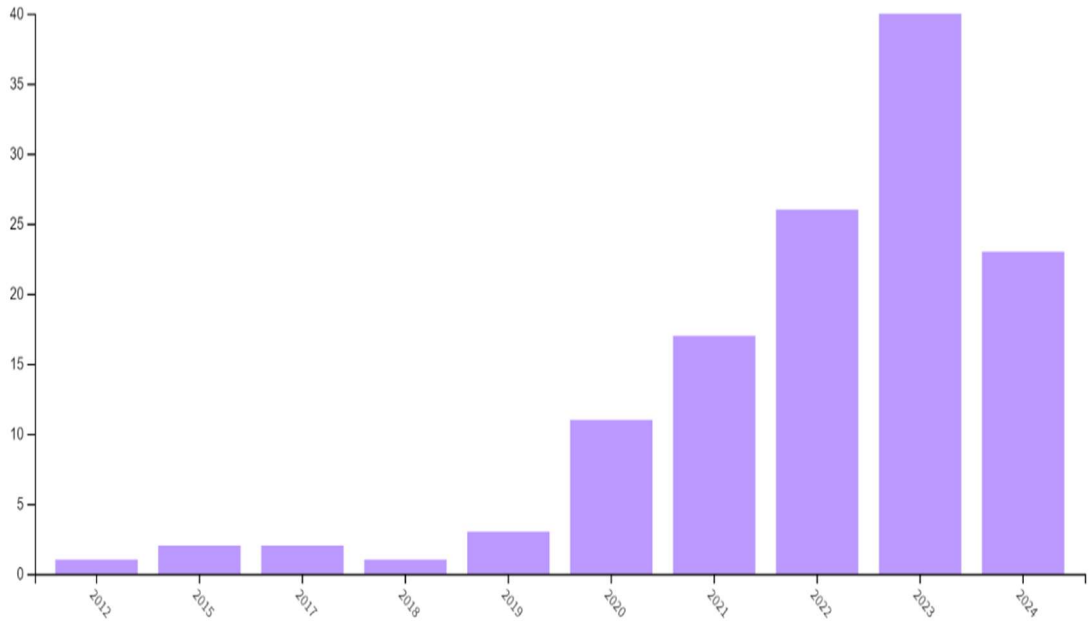
Table 1: Distribution of Publications in the Web of Science Category (2014-2024)

Web of Science Categories	Record Count	% of 129
Geriatrics Gerontology	31	24.031
Gerontology	18	13.953
Medical Informatics	16	12.403
Health Care Sciences Services	13	10.078
Medicine General Internal	13	10.078
Psychiatry	11	8.527
Computer Science Information Systems	8	6.202
Computer Science Artificial Intelligence	7	5.426
Orthopedics Pharmacology Pharmacy Public Environmental Occupational Health Radiology Nuclear Medicine Medical Imaging Surgery	5	3.876

Table 2. Document Type

Document Type	number of registrations	Percentage (%) of 129 articles
Article	83	64.341
Early Access	8	6.202
Editorial Material	4	3.101
Letter	2	1.550
Meeting	1	0.775
Meeting Abstract	7	5.426
Proceeding Paper	10	7.752

Publications



When examining the distribution of publications between 2014 and 2024, it is observed that there were 23 publications in 2024, 40 in 2023, 26 in 2022, 17 in 2021, 11 in 2020, and fewer than three publications in each year prior to 2019 (Figure 1).

When analyzing the distribution of articles by authors, those with three or more publications include: Steger F (n=4), Dallmeimer D (n=3), Denkinger M (n=3), Fotteler M (n=3), Gao XS (n=3), Huang JW (n=3), Jaboni A (n=3), Kim J (n=3), and Leiner C (n=3) (Table 3). It was found that 126 of these published works were in English, two in German, and one in French (Figure 2).

Table 3 Distribution of Publications by Authors*(2014-2024)

Authors	**Record Count**	**% of 129***
Steger F	4	3.101
Dallmeier D	3	2.326
Denkinger M	3	2.326
Fotteler M	3	2.326
Gao XS	3	2.326
Huang JW	3	2.326
Iaboni A	3	2.326
Kim J	3	2.326
Leinert C	3	2.326
*Authors with 3 or more works		

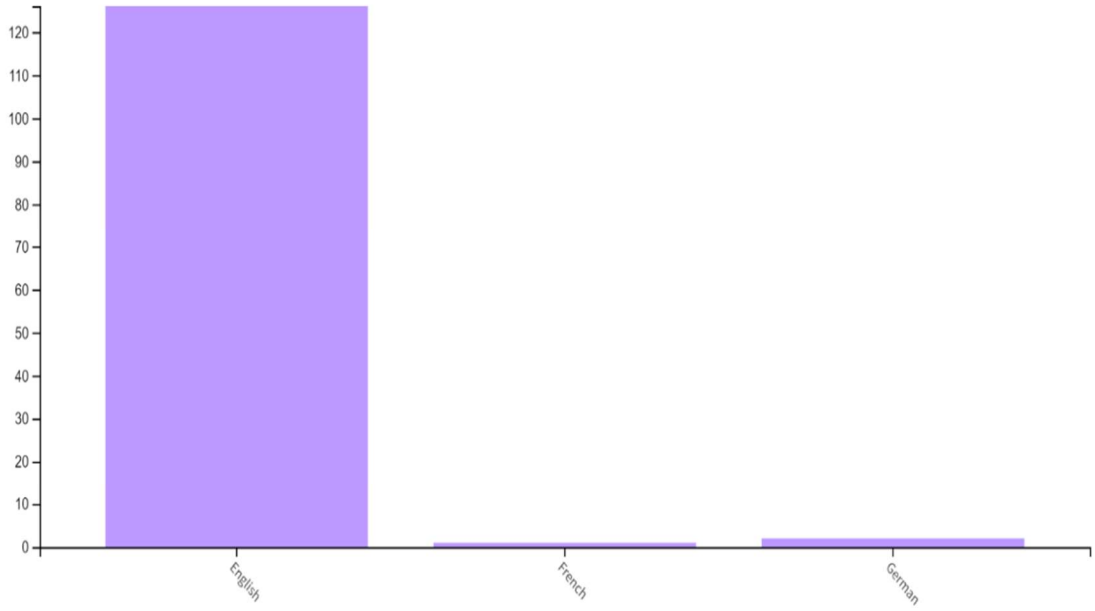


Figure 2 Publication language chart

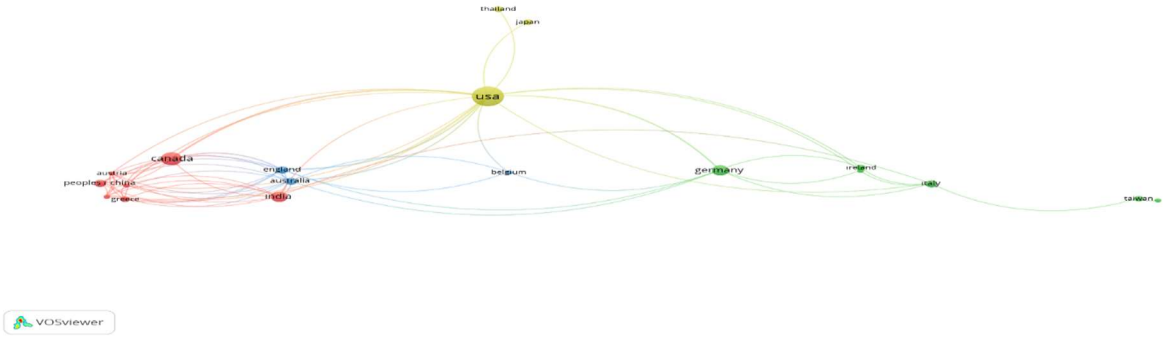


Figure 3 Distribution of co-authors by countr

When analyzing the distribution of co-authors by country, considering each country must have at least one author and one citation as criteria, it was found that the USA, with 21 documents, has connections with 16 countries; Canada, with 9 documents, is connected to 9 countries; Germany, with 6 documents, is linked to 7 countries; and India, with 6 documents, is connected to 10 countries (Figure 3).

When examining the distribution of publications by journal, the *Journal of the American Geriatrics Society* had the highest publication frequency, representing 3.876% of the total, followed by *BMJ Open*, *Frontiers in Psychiatry*, and *Journal of Medical Internet Research*, each with 3.101% (Table 4).

Regarding keywords used in the studies, "artificial intelligence," "geriatric," "machine learning," and "older adults" were the most frequently used terms (Figure 4).

Table 4. Published Journal

Publication Titles	Record Count	% of 129*
Journal Of The American Geriatrics Socıety	5	3.876
Bmj Open	4	3.101
Frontiers In Psychiatry	4	3.101
Journal Of Medical Internet Research	4	3.101
Amerıcan Journal Of Geriatric Psychiatry	3	2.326
Frontiers In Medicine	3	2.326
International Journal Of Environmental Research And Public Health	3	2.326
Plos One	3	2.326
*3 and above studies		

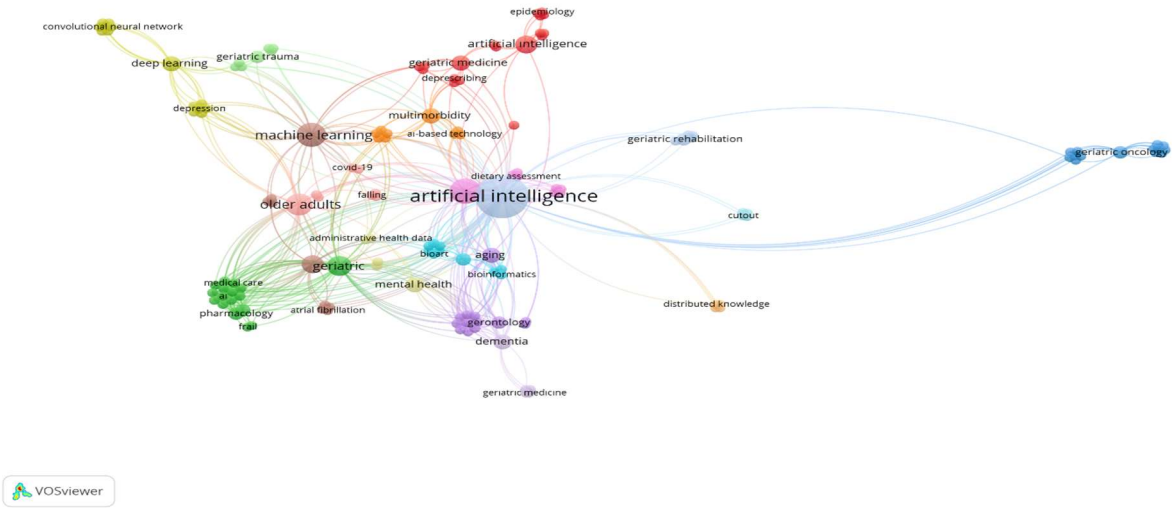


Figure 4 Visualization of keywords

In this study, a bibliometric analysis was conducted using the WoS Core Collection database and VOSviewer software on 129 studies published in the Web of Science database related to artificial intelligence in geriatrics, meeting the inclusion criteria. The study categorizes these works in the international literature on geriatrics and artificial intelligence, examining the number of publications per year, the authors and countries with the most studies, and the trends in journals publishing these works.

Our aims include conducting a comprehensive analysis of the field to identify the research focus areas and gaps. In line with our objectives, it was determined that “machine learning” is frequently a focal point within the geriatric population based on commonly used keywords in these publications.

The acceptance of machine learning in geriatrics has become a significant research topic, especially with the recent adoption of technology among the elderly population. Older adults' approach to technology can directly influence the effective use and development of AI applications. When the target user group resists these technologies, it may hinder fully leveraging their advantages (Goher et al., 2017). Thus, recent studies have delved deeply into elderly individuals' attitudes toward AI-based geriatric care services (Goher et al., 2017).

Studies from various countries have investigated older adults' attitudes toward technologies like smart care solutions, companion robots, and daily life support robots, as well as the factors influencing these attitudes. Research in Finland, Ireland, and Japan examined the acceptance of home-care robots by elderly individuals and highlighted the challenges faced in this process (Suwa et al., 2020). Such studies demonstrate that older adults' adaptation to technology is critical for successfully integrating AI applications. The findings reveal that each country has developed a unique perspective on these technologies, with older adults in Finland showing a more negative attitude toward robots compared to their counterparts in the other two countries (Suwa et al., 2020). These differences may be related to the historical trajectories, cultural values, policies, and societal norms that shape AI development in each country.

According to our research findings, "artificial intelligence" and "geriatrics" are frequently used keywords. In the literature, these terms are seen in nursing studies focused on organizing nursing care processes. AI provides essential support for monitoring, tracking, and classifying activities and health data for dependent individuals or family caregivers (Seibert et al., 2021; Ye et al., 2020). AI has been effectively applied in areas such as detecting, classifying, and preventing falls, recognizing and reducing alarms, and predicting and categorizing pressure ulcers (Seibert et al., 2021; Ye et al., 2020).

Our study observed that most research on AI technology has been concentrated within the last five years. This concentration can be attributed to AI being a relatively new technology. AI is recognized as a rapidly evolving innovation in technology, drawing the attention of researchers (Wang et al., 2023). Additionally, the accelerated maturation process of this technology has led to increased research and diversified applications. Over the past five years, growing awareness of AI’s potential and its applicability across various fields have significantly increased related studies.

Upon analyzing the work of the most prolific authors, we observed that their studies focus on the ethical dimensions of AI technology in clinical applications (Orzechowski et al., 2023; Skuban et al., 2023). Low technological literacy among elderly patients may lead to trust issues regarding these devices. Although there has been progress in this field in recent years, broader, patient-centered approaches are needed to foster acceptance of this technology from both clinical and medical-ethical perspectives.

Study’s Limitations: The primary limitations of our study include data being

drawn from only one database and the content of the studies not being assessed.

Conclusion: In this study, it was found that 9 authors made substantial contributions, with Skuban-Eiseler T having the highest number of studies and citations on this topic. The highest number of publications originated from the USA, Canada, and Germany. The results showed that publication rates increased after 2019, and the most frequently used and connected keywords were "geriatric," "artificial intelligence," "machine learning," and "older adults." The findings of this study are expected to provide a comprehensive perspective on the current state of research, guide future research endeavors, and contribute to the national literature.

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