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Original Article

A Bibliometric Analysis of AI in Healthcare: Current Status and Development

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Abstract: *The application of AI has attracted great interest in healthcare. This study examines the association between AI and Healthcare by analyzing metadata from 960 Scopus-indexed papers (2019-2025) using the keywords "AI" OR "Artificial Intelligence" AND "Healthcare". The study identifies major publication sources, trends, and volumes by conducting citation, co-citation, and keyword co-occurrence studies using VOSviewer. The software analysis focuses on the most influential journals, organizations, nations, keywords, international collaborations, and publications in this area. The 'BMC Medical Education' journal has the highest growth rate, with 40 publications. The author Zhang L has published the most documents (6). 'The University of Singapore' has the most contributions in this field with 35 publications. 'The United States' has the most publications (565) and total citations (1879). The VOSviewer software visualizes mapping based on co-citation, bibliographic coupling (BC), and co-occurrence (CO). The primary limitation of the study is its dependence on Scopus data. Linking and analyzing this data can help keep track of how the topic has changed over time. This study offers significant insights for researchers and academics aimed at fostering the advancement of methodologies to optimize the utilization of AI in healthcare and formulating a research agenda for continued investigation in this vital domain. This study offers significant insights for both social science researchers and academic practitioners.*

Keywords: *AI, Artificial Intelligence, Healthcare, Bibliometric Analysis.*

I. INTRODUCTION

Artificial Intelligence (AI) is changing healthcare by using algorithms and data analysis to help with precise diagnosis, personalized treatments, drug discovery, and efficient patient care (Zeb et al., 2024). It helps doctors make decisions faster and better, cuts down on medical mistakes, and makes healthcare more accessible, which makes it more effective and focused on the patient (Davenport et al., 2019). The healthcare industry is changing a lot. This revolution is happening because healthcare costs are going up, and there aren't enough doctors and nurses (Vaananen et al., 2021). This makes the healthcare industry want to use new IT-based methods and solutions that could save money and help with these new problems (Shaheen, 2021). Healthcare technology firms before 2010 concentrated on the advancements made possible by medical devices that offered evidence-based and historical care. Since 2010, work has concentrated on outcome-based care and real-time medical platforms (Sadeghi et al., 2024). Technology is shifting towards medical solutions starting in 2020, offering intelligent solutions for evidence- and outcome-based health with an emphasis on preventative and collaborative treatment (Antti et al.,2021).

Applications of AI in healthcare fall into the following categories: healthcare monitoring, medication management, clinical trials, cybersecurity, machine vision, medical consultation, surgery, nursing assistant, administration and workflow, treatment design, and automatic and preliminary diagnosis (Kalra et al.,2024). AI is used in applications across all of these fields (Hirani et al., 2024). Artificial intelligence holds genuinely amazing possibilities for the healthcare industry (Kumar, R. 2025).

AI is predicted to significantly change how we handle medical data, identify illnesses, create cures, and perhaps stop them before they start (Gonzalez-Moral et al.,2025). Artificial intelligence can help healthcare providers make better decisions by providing them with more accurate information. This can save time, lower expenses, and improve the management of medical records in general (Garcia et al., 2025). AI in healthcare holds great promise for revolutionising everything from finding novel cancer treatments to enhancing patient experiences. It will pave the way for a time when patients will receive high-quality care and treatment more quickly and precisely than possible (Steve Barth, 2023).

Machine learning is an important aspect of Artificial intelligence in healthcare, by which treatment and medical facilities have been greatly improved (Jordan et al., 2015). A large amount of data can be processed by computers, hence

finding trends and making previously unheard-of predictions about medical outcomes (Nozarijouybari et al., 2024). By machine learning, medical personnel can improve treatment facilities and lower costs by helping in the analysis of patient records, medical imaging, and the discovery of new therapeutics (Teo et al., 2024). By machine learning, diseases can be diagnosed very clearly, provide individualised care, and identify the smallest change in signs that can easily find out health problems (Tilala et al., 2024). By supervised learning, a very popular application, precision medicine, forecasts successful plans based on patient-specific data (Ramirez et al., 2024).

Computers can easily understand and utilise human language very clearly through Artificial Intelligence called Natural Language Processing (NLP) (Jerfy et al., 2024). By the use of natural language processing, the healthcare sector has changed a lot. Various applications of natural language processing in health data include improving patient care by improving the accuracy of diagnoses, accelerating clinical procedures, and providing more individualised services (Sarella et al., 2024). For effective discovery of disorders, NLP can be used to gain valuable information from health data. NLP can also be used to predict possible health outcomes or find out appropriate therapies and medications for every patient (Zheng et al., 2024).

With AI, most of the administrative work of medical care has changed. With AI, healthcare organisations and providers can easily focus on patient care and revenue cycle management to automate repetitive operations such as data entry, claims processing, and appointment scheduling (Bedi et al., 2024). Human error can also be decreased by proper use of artificial intelligence because AI offers a quicker method of reviewing medical imaging, test findings, claims processing, and health records (Muley et al.,2023).

AI can be highly helpful in the research and discovery of new drugs. AI algorithms can find possible drug targets, improve drug design, and speed up clinical trials by assessing enormous volumes of scientific literature and biomedical data (Barlow et al., 2024). Patients may receive novel treatments more quickly and effectively as a result of this. Considerably, while AI has significantly improved healthcare now, its prospects are considerably brighter (Adeghe et al., 2024). The growing availability of healthcare data and developments in AI algorithms can further increase the precision and effectiveness of diagnostic procedures, facilitate personalised medication, and boost (Christina Silcox et al., 2024).

II. MATERIALS AND METHODS

Every academic subject needs to examine its past research to advance. Different approaches can be applied to summarize published research, such as qualitative and quantitative literature reviews. Two techniques for quantitative analysis that offer an unbiased summary of the body of literature are scientific mapping using meta-analysis and bibliometric analysis. Science mapping examines the relationships between areas, fields, articles, and authors through bibliometric methodologies. Bibliographic coupling happens when two documents both cite a third document. Bibliographic coupling finds out how similar two published papers are by looking at how many sources they have in common. The number of shared references is related to how similar the two things are.

This study utilizes bibliometric analysis, concentrating on citation, co-occurrence, and journal analyses as the principal methodologies. Citation analysis examines inter-citation dynamics, encompassing scope, the establishment of a citation database, and the assessment of citation relationships and metrics (Rousseau et al., 2018). Co-occurrence analysis identifies field relationships and focal points by analyzing the frequency and context of shared keywords, themes, or authors, resulting in the creation of matrices and the visualization of relationships (Kiili et al., 2023). Journal analysis evaluates publication patterns and networks by pinpointing significant journals and examining their metrics and trends (Mongeon & Paul-Hus, 2016). Bibliometrics quantitatively examines citation relationships, author collaborations, and trends in topic development, revealing research focal points and hotspots within a discipline. This methodology offers a thorough and profound research perspective, elucidating the interconnections between topics and the present condition and prospective trends of subjects (Zupic & Čater, 2015).

Bibliometrics is a part of library and information science that uses numbers to look at bibliometric data. Previous research (Bonilla et al., 2015) investigates the overarching trends related to a specific subject, such as a journal, research domain, or geographic region. Bibliometric analyses have been utilized to evaluate the significance of journals (Amiguet et al., 2017; Marinez-Lopez et al., 2018), countries (Merigo et al., 2016), and research topics (Farrukh et al., 2021). The current research employed the VOSviewer tool to illustrate bibliographic content (Van Eck et al., 2010). The VOSviewer changes bibliographic data into graphs. This investigation used many bibliometric techniques, including bibliographic coupling, co-citation, and co-occurrence of author keywords.

A) Main Information on the Data Source: Analysis of Scopus Data with Biblioshiny

The Scopus database was used to identify the publications. One of the largest, peer-reviewed research databases in the Social Sciences is Scopus. According to Donthu et al. (2020), the repository is well-known and widely used for analytical and quantitative analyses. The study focused solely on articles and review documents, using journals as the only source type.

After selecting search keywords, the authors conducted a bibliometric literature search. Scopus is one of the most commonly used databases with a complete overview of the global study yield, as well as a widely used search engine. It was used to collect data for the current exploration. A search using the keywords "AI" OR "Artificial Intelligence" AND “Healthcare” yielded 6613 papers. The research records were collected in 2025, but as the Scopus database is updated frequently, the results could alter later. The articles were selected from 2019 to 2025, and 536 articles were published before 2019. This resulted in 6077 documents. After filtering, the subject areas were selected as Social Sciences and Business Management and Accounting, 2435 documents were removed, and document types articles were filtered, and 1557 documents were removed. Only English-published journal articles and reviews were considered. This process eliminated 5219 extra papers. Lastly, 1394 articles were left after all filtration.

RStudio is an integrated development environment (IDE) designed specifically for the R programming language, which is widely used for statistical computing, data analysis, and data visualization. It provides a user-friendly interface that combines a script editor, console, environment/workspace viewer, and powerful tools for plotting and debugging. RStudio enhances productivity by allowing users to write, test, and visualize code efficiently within one platform (Verzani, 2011). By making it possible to use packages like bibliometrix, which enable thorough scientific mapping using data from Scopus and Web of Science, RStudio has revolutionised the area of bibliometrics (Aria & Cuccurullo, 2017). Key bibliometric research methodologies such as authorship networks, topic evolution, keyword co-occurrence, and co-citation analysis are supported by these tools. Because it provides transparency, repeatability, and scalability in the study of academic literature, RStudio's open-source and script-based environment has thus become essential to contemporary bibliometric investigations.

Figure 1. Main information on the data source: Analysis of Scopus data with Biblioshiny

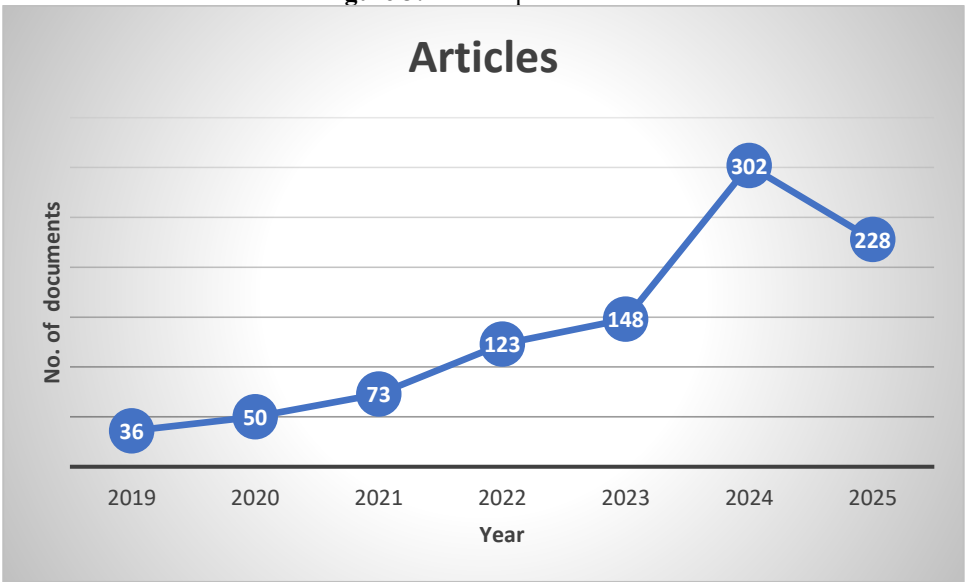
Source: *Compiled by authors from Scopus database*

III. RESULTS

A) Publication Trends

Over the period 2019-2025, publications surged steadily. In 2019, only thirty-six publications were published. Over time, the number steadily grew, with significant increases in the next years. By 2025, the publications reached an impressive 228, indicating a substantial rise. The observed growth suggests that there is a rise in academic interest as well as the widespread use of AI in higher education (Figure 3).

Figure 3: Annual publications

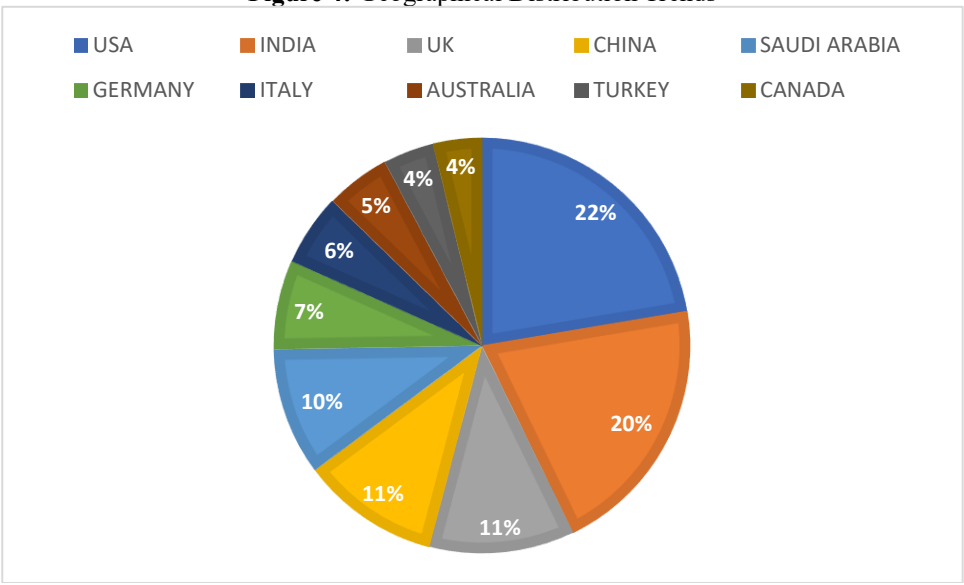


Source(s): *Authors' own computation using Biblioshiny Software with Microsoft Excel*

B) Geographical Distribution Trends

The geographic distribution of scientific publications on AI and higher education is shown in Figure 4. According to the figure, the most productive countries in this bibliometric analysis are the USA (549), India (503), and the UK (277). Canada is the least-producing country, with 93 publications only. When developing nations like India, China, Bangladesh, and Brazil are compared with developed nations like the USA, Australia, Canada, Germany, and the UK, it becomes clear that the majority of research is done in these regions. Researchers can now carry out more studies in emerging and less developed countries due to regular technological improvements.

Figure 4: Geographical Distribution Trends



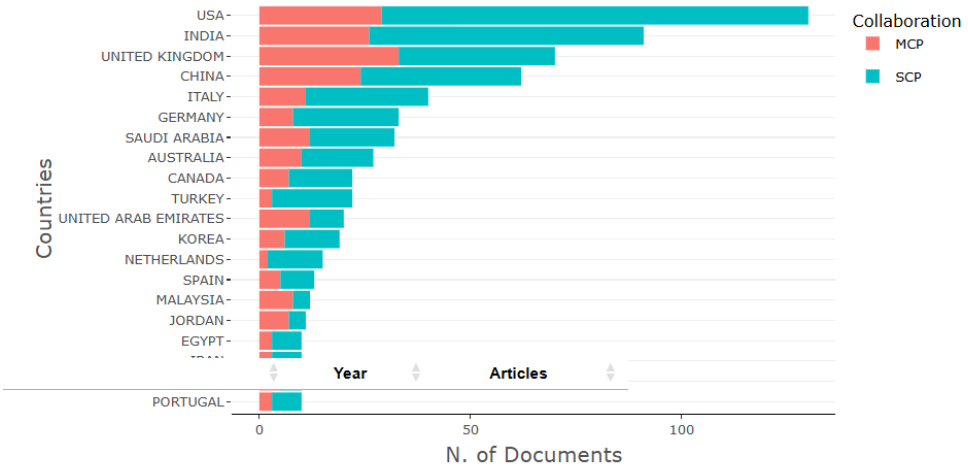
Source: *Authors' own computation using Biblioshiny Software with Microsoft Excel*

C) Country-wise Research Collaboration Patterns

The figure illustrates the distribution of research publications across various countries, categorized by single-country publications (SCP) and multiple-country publications (MCP). The United States leads with the highest number of documents, dominated by SCP, indicating a strong independent research capacity. India ranks second, showing a relatively higher proportion of MCP, which reflects greater involvement in international collaborations compared to the USA. Other countries

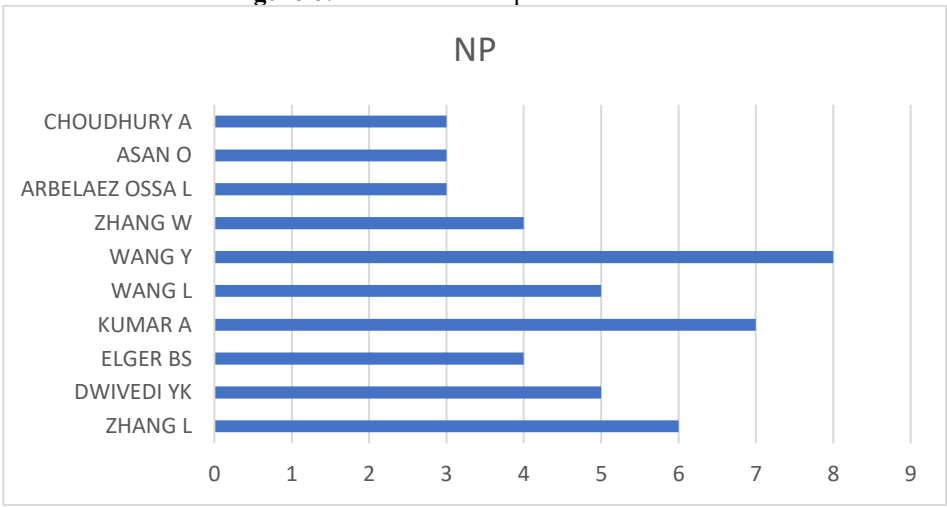
such as the United Kingdom, China, Italy, and Germany also make notable contributions, with a balanced mix of SCP and MCP. Meanwhile, countries like Saudi Arabia, Australia, Canada, and Turkey contribute moderately, while smaller outputs are observed from nations such as Malaysia, Jordan, Egypt, and Portugal. Overall, the chart highlights both the scale of research productivity and the collaborative research patterns across countries.

Figure 5. Research Output by Country and Collaboration Type



Source(s): *Authors' own computation using Biblioshiny*

Figure 6: Production of top authors over time



Source(s): *Authors' own computation using Biblioshiny*

Table 1: The most creative authors

Author	h_index	g_index	m_index	TC	NP	PY_start
Zhang L	5	6	0.714	90	6	2019
Dwivedi Yk	4	5	0.8	2888	5	2021
Elger Bs	4	4	0.8	128	4	2021
Kumar A	4	7	0.8	167	7	2021
Wang L	4	5	0.8	113	5	2021
Wang Y	4	8	1	195	8	2022
Zhang W	4	4	1	70	4	2022
Arbelaez Ossa L	3	3	1	91	3	2023
Asan O	3	3	0.75	91	3	2022
Choudhury A	3	3	0.75	91	3	2022

Source(s): *Authors' computation using Biblioshiny Software*

D) The most productive authors

Table 1 displays important publication metrics for prominent scholars, such as h-index, g-index, year of first publication, total citations (TC), and number of publications (NP). With the most publications (6) and a substantial citation impact (90), Zhang L is particularly notable for their steady research contributions since 2019. Dwivedi Yk comes next with 5 publications but a far greater number of citations (2888), indicating that he has a significant impact in his field, even though he has written fewer papers. Their consistent publishing records and solid citation counts demonstrate the expanding importance of other prominent authors, like Elger Bs, Kumar A, and Wang L.

The findings show that while some authors have more publications, others have a greater impact per article. The combination of total citations, h-index, and g-index reveals information on both productivity and influence in the study field.

E) Analysis of Keyword Co-occurrence

This figure is a word cloud, which is a way of visually showing the most common or important words in a text or collection of documents. In this word cloud, the largest and most prominent word is **"**artificial intelligence", meaning it is the central and most frequently discussed concept. Surrounding it are other key terms like **"**healthcare," **"**human," **"**humans**,"** "health care," and "machine learning," which appear in relatively large sizes, indicating that these are also important topics often linked with artificial intelligence. Smaller words such as "decision making," **"**ethics," **"**medical," **"**article," **"**deep learning," **"**covid-19," "female," and "male" represent additional but less frequent themes connected to the main topic. The overall message of this word cloud is that discussions or research around artificial intelligence are strongly focused on its role in healthcare and its relationship with humans, while also touching upon related issues like decision-making, ethics, and modern technologies such as machine learning and deep learning. In simple terms, the figure highlights artificial intelligence as the core subject, with healthcare and human factors being the most important areas of application and concern. This word cloud suggests that the central theme is artificial intelligence**,** with major connections to healthcare and humans**,** along with sub-themes like machine learning, decision making, ethics**,** and deep learning**.** In short, it shows that discussions around AI are strongly linked with healthcare and human-centered issues.

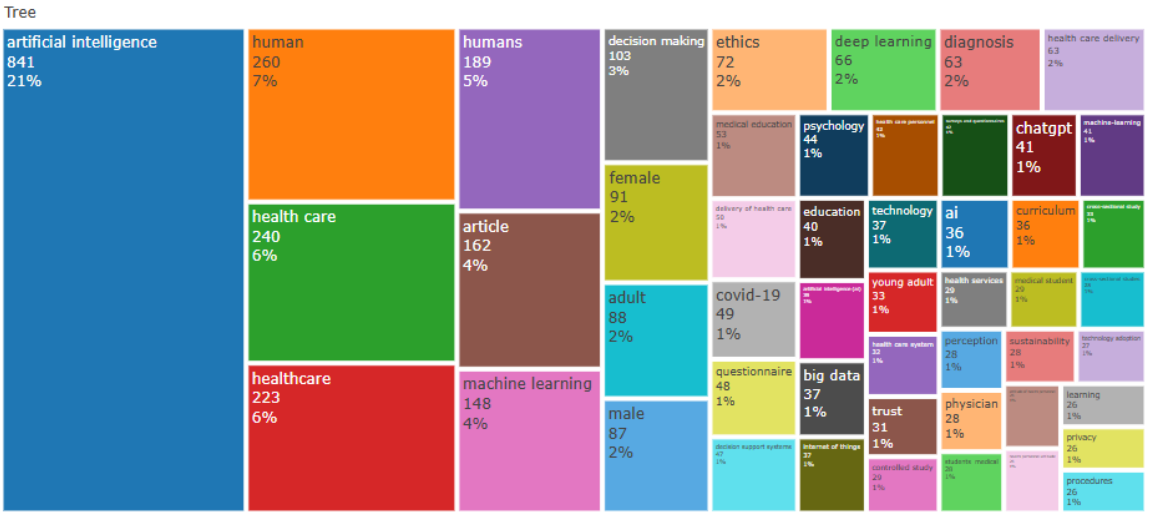
Figure 7: Cloud on Artificial Intelligence

Source(s): *Authors' own computation using Biblioshiny*

F) AI-Related Themes Treemap

This figure is a **treemap** that visualizes the distribution of major themes related to artificial intelligence. The largest block, **"**artificial intelligence" **(**841, 21%), shows that it is the most dominant topic. Other significant themes include human (7%), health care (6%), healthcare (6%), humans (5%), article (4%), and machine learning (4%). Smaller blocks such as decision making, ethics, deep learning, diagnosis, female, adult, and COVID-19 highlight supporting areas of interest, while terms like ChatGPT, big data, trust, privacy, and curriculum represent emerging but less frequent themes. Overall, the treemap emphasizes that discussions on artificial intelligence are strongly centered on healthcare and human-related factors, with additional focus on technology, ethics, and education.

Figure 8: Keyword Distribution in Research Publications



Source(s): *Authors' own computation using Biblioshiny*

G) Relationship between sources, authors, and keywords

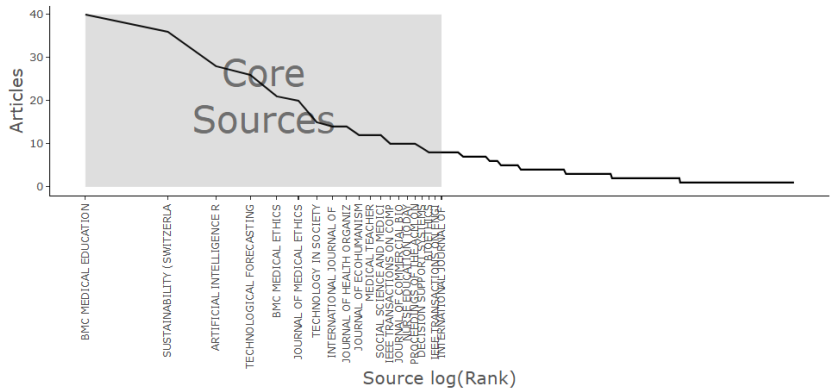
Figure8 . displays three field studies of the link between sources, authors, and keywords. The left column contains source names, the middle column contains author names, and the right column contains keywords. The majority of authors used higher education, ChatGPT, and artificial intelligence as keywords. However, other authors employ phrases such as generative AI, generative artificial intelligence, higher education, teaching, etc., and many others. The British Journal of Educational Technology makes a major contribution in this field.

H) Most productive journals

It is a core source plot (also known as Bradford's Law distribution). It shows how research articles on artificial intelligence are distributed across different journals. The y-axis represents the number of articles, while the x-axis ranks the journals (sources) in descending order of productivity.

From the plot, a small group of core journals—such as BMC Medical Education, Sustainability (Switzerland), and Artificial Intelligence Review—contribute the highest number of articles (close to 40 each). As the curve moves right, the number of articles per journal declines sharply, showing that most journals publish only a few papers on the topic.

Figure 9: Core Sources of Research Publications



Source(s): *Authors' computation using Biblioshiny Software*

Bradford's law: Bradford's scattering law (1: n: n2), which predicts an increase in journal production as one moves from one zone to the next, can be used to divide the total number of citations into three equal zones (Bradford, 1985). It was discovered that the top 14 journals were located in the first zone, also referred to as Bradford's zone of core sources or trace 2 journals.

Table 3: Bradford's Trace 2 Journals name

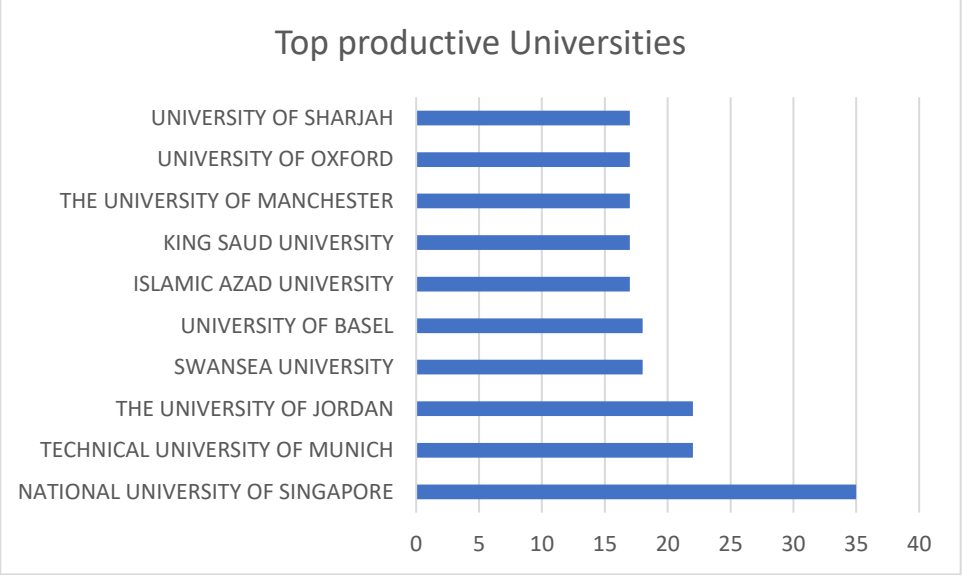
SO	Rank	Freq	cumFreq	Zone
BMC Medical Education	1	40	40	Zone 1
Sustainability	2	36	76	Zone 1
Artificial Intelligence Review	3	28	104	Zone 1
Technological Forecasting And Social Change	4	26	130	Zone 1
BMC Medical Ethics	5	21	151	Zone 1
Journal Of Medical Ethics	6	20	171	Zone 1
Technology In Society	7	15	186	Zone 1
International Journal Of Human-Computer Interaction	8	14	200	Zone 1
Journal Of Health Organization and Management	9	14	214	Zone 1
Journal Of Ecohumanism	10	12	226	Zone 1

Source(s): *Author's own computation using Biblioshiny Software*

I) The Most Efficient Universities and Institutes

The bibliometric analysis aimed to identify the most prolific universities. Table 4 shows that the National University of Singapore was the most productive university. The Technical University of Munich ranked second, the University of Jordan ranked third, the University of Swansea placed fourth, followed by the University of Basel and the Islamic Azad University. The University of Basel ranked fifth, and the Islamic Azad University placed sixth. This study leads to the conclusion that these universities have produced a substantial amount of scholarly work in the relevant field. Their substantial performance implies active research projects, scholarly contributions, and maybe leading positions within their specialized fields.

Figure 10: The ten most productive universities



Source(s): *Authors' own computation using Biblioshiny Software*

IV. CONCLUSION

The application of AI has attracted great interest in healthcare. This study examines the association between AI and Healthcare by analyzing metadata from 960 Scopus-indexed papers (2019-2025) using the keywords "AI" OR "Artificial Intelligence" AND "Healthcare". The study identifies major publication sources, trends, and volumes by conducting citation, co-citation, and keyword co-occurrence studies using VOSviewer. The software analysis focuses on the most influential journals, organizations, nations, keywords, international collaborations, and publications in this area. The 'BMC Medical Education' has the highest growth rate, with 40 publications. The author Zhang L has published the most documents (6), and 'The University of Singapore' has the most contributions in this field with 35 publications. 'The United States' has the most publications (565) and total citations (1879). The VOSviewer software visualizes mapping based on co-citation, bibliographic coupling (BC), and co-occurrence (CO). The study's main constraint is its reliance on Scopus data. Linking and analyzing this data can help track the evolution of the topic. This study provides valuable insights for researchers and academics for promoting the development of methods to enhance the efficient use of AI in healthcare and establishing a research agenda for further exploration in this critical area. This study provides valuable insights for social science researchers and academic practitioners alike.

There are a lot of exciting things that AI could do in healthcare in the future. Personalized medicine is one of the most interesting uses of AI in healthcare. Personalized medicine involves tailoring medical care to a person's unique environment, lifestyle, and genetic makeup. AI can look at huge amounts of data and come up with personalized treatment plans that meet each patient's unique needs. Another interesting application of AI in healthcare is the detection and prediction of diseases. AI can analyze data from various sources, including environmental data, medical records, and genetic tests, to identify individuals who are more likely to develop specific diseases. This information can be used to make plans to stop diseases from spreading.

AI could completely change how drugs are found. AI can analyze vast amounts of data to identify new drug targets and develop treatments that are more effective. AI can help make clinical trials more efficient, which can save time and money when bringing new drugs to market. People are worried that AI might make it easier for bias and discrimination to happen in medicine. For example, biased data can lead AI algorithms to make biased choices that hurt certain groups of people. Using AI in healthcare also brings up questions about rules and regulations. It is essential for regulatory bodies to monitor the development and application of AI algorithms to ensure they are safe and effective.

AI in healthcare can completely change how patients are cared for by making things more efficient, cheaper, and better. But in order to make sure that AI is used safely and effectively in healthcare, ethical and legal issues must be worked out. We can utilize AI to enhance patient care and advance medical research, but we must ensure that the technology is employed fairly and responsibly by implementing robust regulations and addressing moral concerns.

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