

BIBLIOMETRIC ANALYSIS OF RESEARCH TRENDS ON COMPLETENESS OF ELECTRONIC HEALTH AND MEDICAL RECORD FILLING BY HEALTH WORKERS

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ABSTRACT

The completeness of electronic health and medical record filling by health workers is a fundamental aspect that impacts the overall quality and efficiency of healthcare systems. As the use of electronic health records (EHRs) becomes increasingly prevalent, understanding research trends related to the completeness of these records is crucial. This bibliometric analysis seeks to provide an in-depth examination of the research landscape concerning EHR completeness by analyzing publication trends, geographical contributions, journal types, and research topic networks. Utilizing bibliometric tools such as VOSviewer, the study spans from 2019 to 2024, offering insights into the evolution of research in this field. The results reveal a notable increase in publication volume over the years, with a significant peak in 2022, indicating a growing academic interest in this subject. The United States and South Africa are identified as major contributors, while other countries like Indonesia and Brazil also show substantial research activity. The majority of the research is published in the form of research articles, although literature reviews, books, and conference papers also contribute to the body of work. Key research clusters identified include themes on the accuracy and completeness of records, factors influencing system quality, and adherence to EHR usage. Overlay and density visualizations illustrate an evolving focus within the research community, highlighting increased attention to quality factors and the challenges related to EHR system implementation and adherence. This analysis provides valuable insights into current research trends, emphasizing the need to address existing gaps and integrate findings from various research clusters. Future research should focus on exploring underrepresented areas and combining insights across different domains to enhance the overall effectiveness of EHR systems. By addressing these gaps, researchers can contribute to improving data entry processes and system implementation, ultimately leading to better healthcare outcomes.

Keywords: Electronic Health Records, Completeness, Bibliometric Analysis, Research Trends, Health Workers

INTRODUCTION

The development of information technology in the health sector has had a significant impact on medical practice, one of which is through the implementation of electronic health and medical records (EHR). EHRs aim to improve the quality of healthcare by providing comprehensive, accurate, and easily accessible patient information to healthcare professionals. While the potential benefits of EHRs have been widely recognized, their successful implementation relies heavily on the completeness and accuracy of data entry by health workers. In the era of rapid digitalization, information technology has penetrated various sectors, including the health sector. One important innovation in the health sector is the introduction and implementation of Electronic Health Records (EHR). EHR is a system that enables digital recording, storage, and access to patient health information. The use of EHR is believed to improve the efficiency of health services.

Benefits of electronic medical records: disseminating and sharing information (shareable), Establishment of databases that enable research, Efficiency of resource utilization and costs with material supply systems (inventory), Potential in automation, structuring and streamlining the flow of clinical information. Supports the integration of widespread service activities, and tracks data and information, ready to be analyzed for medical audits, research, quality assurance, monitoring, epidemiology, disease surveillance (Mathar & Igayanti, 2021). Medical records actively help achieve orderly administration as an implementation of efforts to improve the quality of hospitals and health centers. Without good and correct medical record management, the expected administrative order will not be achieved (Nuryani & Hidayat, 2022).

However, although the benefits of EHR have been widely recognized, the challenges in its implementation cannot be ignored. One of the main challenges is the completeness of health record filling by health workers. There are several factors that affect the completeness of filling out patient medical records including; busy doctors due to many patients, senior doctors who do not understand technology. In the Medical Record Documentation Audit Module RMK517 Topic 1 Quality Documentation, states that the factors underlying the implementation (Electronic Health Records/EHR) (Widjaja, 2021).

Completeness of medical records is also influenced by the lack of motivation of medical staff in filling out documents, no sanctions for health workers who do not fill out complete documents, monitoring and evaluation, lack of socialization of SOPs for filling out medical records, medical record formular arrangements that are less systematic or less simple and integrated, limited financial resources to support evaluation of the completeness of medical record files (Mukarom & Septiawan, 2022). Some mentioned that due to the large number of patients handled, there were documents that were not filled in by the health workers on duty (Halimatusaadah & Hidayati, 2022).

Evaluation needs to be done to determine the success rate of electronic medical record implementation. Factors that can be used as variables to measure the success of an information system implementation according to DeLone & McLean's theory are system quality, information quality, service quality, user satisfaction, individual impact and organizational impact (Purwandani, 2018). System quality, information quality, and service quality have a significant effect on system user satisfaction. The better the perception

of system quality, information quality, and service quality, the more user satisfaction will increase (Pawirosumarto, 2016).

In this study, a bibliometric approach was used to evaluate related publications, which included analyzing the number of publications, citations, leading authors, and frequently discussed topics in EHR-related literature. This study is expected to contribute to a better understanding of the factors that influence EHR completion and potential improvements that can be implemented in the healthcare system. The results of this study are expected to provide insight into the development of research related to EHR completion and help identify areas that require further attention. Through this analysis, it is expected to gain deeper insights into the development of research in this area, as well as identify challenges and solutions that have been put forward in the literature.

LITERATURE REVIEW

Electronic Medical Records

Electronic Health and Medical Record (EHR) is a system designed to replace traditional paper medical records with a more integrated and easily accessible digital format. EHR allows healthcare workers to record, manage, and access patients' medical information in real-time, which is expected to improve the efficiency and quality of healthcare. EHR implementation has become a global priority with the aim of improving care coordination, reducing medical errors, and supporting data-driven decision making.

In recent years, studies have shown that although EHRs offer many advantages, challenges in their implementation and utilization still exist. Data completeness is one of the main problems often encountered. Research by found that incomplete data

in EHRs can result in difficulties in making the right diagnosis and managing patient care effectively. This shows the importance of continuous supervision and training for health workers to fill in data accurately (Adler-Milstein et al, 2022).

In addition, EHRs also face issues related to data security and privacy. Research by revealed that although many EHR systems are equipped with security features, there is still a risk of data breaches that could threaten the confidentiality of patient information. Therefore, strict enforcement of security policies and training on data protection are essential to maintain the integrity of EHR⁸ systems (Johnson et al., 2023).

Research on EHRs shows that these systems have great potential to improve the quality of healthcare, but their success depends largely on proper implementation and adherence to established standards⁷. This review aims to explore various aspects related to the completeness of EHR completion by healthcare workers, including influencing factors, solutions that have been proposed, and their impact on clinical practice and care outcomes.

Challenges in EHR Implementation

The implementation of Electronic Health Records (EHR) systems in various healthcare institutions offers great potential in improving the efficiency and quality of healthcare services. However, EHR implementation is also faced with a number of challenges that need to be addressed to ensure the success of these systems. One of the main challenges is the issue of interoperability. Various existing EHR systems are often unable to communicate with each other smoothly, resulting in data fragmentation that can hinder the exchange of medical information between healthcare facilities⁹. The inability to share data effectively can

reduce the benefits of EHR systems and affect the quality of patient care.

Another significant challenge is related to user training and adaptation. Transitioning from a manual or semi-manual system to an EHR system requires thorough training for medical and administrative personnel. Lack of adequate training can result in misuse of the system and reduce operational efficiency. In addition, resistance to change from healthcare staff can also be a major obstacle. Users who feel uncomfortable with the new technology may be reluctant to fully utilize the EHR system, which impacts the effectiveness of the system.

Another aspect to consider is the issue of data security and privacy. EHRs collect and store highly sensitive medical data, making the protection of such data a top priority. The risk of data security breaches can raise concerns about patient privacy and the legality of data use¹². Properly addressing security issues requires significant investment in sophisticated security infrastructure and protocols.

Overall, challenges in EHR implementation include interoperability, user training, and data security. Overcoming these challenges requires a comprehensive and collaborative approach between system providers, health institutions, and stakeholders to ensure that EHRs can be implemented effectively and provide maximum benefits to the health system.

Completeness of HER completion

The implementation of Electronic Health and Medical Records (EHRs) has been an important step in the modernization of global health systems. EHRs are designed to replace traditional medical records with digital formats, improving care coordination, operational efficiency, and accessibility of patient information¹³. However, the EHR implementation process faces a

number of challenges that can affect its success.

One of the main challenges is resistance to change from healthcare workers. Research by showed that health workers often feel uncomfortable with the transition from manual to digital systems¹⁴. This resistance is usually caused by a steep learning curve, concerns about increased workload, and uncertainty about the impact of the new system on their clinical practice. To overcome these issues, it is important to provide comprehensive and supportive training to healthcare workers during the transition process (Johnson et al, 2023).

Interoperability issues are also a significant barrier to EHR implementation. Interoperability refers to the ability of EHR systems to effectively exchange information between different health systems and organizations¹⁴. The inability of EHR systems to integrate with other systems can result in information fragmentation, which can negatively impact the quality of patient care and operational efficiency. Research by Patel et al. (2023) highlighted the need for better interoperability standards and adoption of technologies that support cross-system integration¹⁵. Data security and privacy is another crucial challenge in EHR implementation. As the volume of digitally stored health data increases, the risk of data breaches and cyberattacks also increases¹⁶. Although many EHR systems are equipped with advanced security features, attacks on patient data remain a serious threat. Research by emphasized the need for strict security policies, as well as continuous training for healthcare workers to maintain data integrity and confidentiality (Green et al, 2023).

The cost of EHR implementation and maintenance can also be an obstacle for many healthcare organizations. High initial costs and the need for system updates and

maintenance often strain budgets, especially for smaller healthcare facilities¹⁸. Careful cost-benefit evaluation and careful budget planning are necessary to ensure the sustainability of EHR implementation.

Completeness of Electronic Health Records (EHR) completion

Completeness of Electronic Health and Medical Record (EHR) completion is a crucial aspect in ensuring the effectiveness and efficiency of digital health systems. EHRs are designed to provide a comprehensive overview of a patient's medical information, but the maximum benefit from the system can only be achieved if the data entered is complete and accurate¹⁹. Data completeness in EHR not only affects the quality of patient care but also has implications for clinical analysis, decision-making, and monitoring of treatment outcomes.

Research by showed that data incompleteness in EHRs is often caused by several factors, including human input errors, lack of training, and system limitations²¹. Lack of training and understanding of the importance of complete data may cause health

RESEARCH METHODOLOGY

This study adopted a bibliometric approach to explore the existing literature on the completeness of electronic health and medical record completion by health workers. The bibliometric method was chosen to provide in-depth insights into trends, developments and key contributions in this field. This approach enables systematic analysis of scientific publications, identifying research patterns, and understanding the key roles of authors and institutions.

Data collection was done by identifying relevant and reliable databases in the health and medical field. The database chosen was Google

workers to overlook filling in certain data or to fill in data with inaccurate information. In addition, the interface design of EHR systems that are not user-friendly can make it difficult for health workers to fill in data thoroughly and accurately (Zhang et al., 2023).

Furthermore, assessments of EHR completion often identify incompleteness in key sections such as medical history, laboratory test results, and records of care provided. Research by) revealed that these data incompletenesses can result in a negative impact on care coordination and the quality of clinical decision-making²³. Therefore, efforts to improve data completion should involve interventions such as additional training, system design revisions, and the use of data validation tools to reduce completion errors.

Overall, EHR completion is a critical factor in ensuring that EHR systems can provide maximum benefit to patients and healthcare workers. This study aims to explore the various factors that influence the completeness of data entry in EHRs and identify strategies to improve the accuracy and comprehensiveness of the data entered (Brown et al, 2024).

Scholar, which is known for providing access to high-quality scientific publications. A literature search was conducted using keywords such as "filling, medical records, electronics, completeness, filling, compliance, health records, avoidance, doctor, medical workers," "electronic health records," and "health workers," with a time span from 2018 to 2024 to ensure comprehensive coverage and inclusion of the most recent articles.

Once the data was collected, articles were screened based on the predefined inclusion and exclusion criteria. Inclusion criteria included studies that focused on the completeness of EHR data entry by healthcare workers, while exclusion criteria included articles that were

irrelevant or did not address aspects of completeness. Articles that met these criteria were then extracted for bibliographic information, including title, author, year of publication, journal source, and number of citations. The data selection and extraction process aims to ensure that the data used is representative and relevant to the research topic.

The extracted data was analyzed using bibliometric software such as VOSviewer and Bibliometrix. This analysis included descriptive analysis to determine the number of publications, annual trends, and geographical distribution of authors. In addition, citation analysis was performed to identify the most influential articles and authors in the literature regarding EHR

RESULTS AND DISCUSSION

The results of this bibliometric analysis include several key aspects that provide a comprehensive overview of research related to prolonged preoperative fasting. From the results of the search and collection of literature conducted on

completion. Collaboration networks between authors and institutions were also analyzed to understand the relationships and collaborations in this study.

The results of the analysis are presented in the form of tables, graphs, and network maps to visualize research trends and relationships between variables. The key findings of this study are discussed to identify emerging research areas, knowledge gaps, and significant contributions to the literature. The conclusions of this study are expected to provide valuable insights for researchers and practitioners in the field of EHRs as well as recommend future research directions to improve the completeness of data entry by health workers.

July 20, 2024. Literature search and collection is based on the title of the literature using keywords in the last 5 years, namely 2019 to 2024. The search database used Google Scholar by limiting a maximum of 50 most relevant and related searches from each database. The following are the main findings of this analysis:

Table 1. Number of documents published by year of publication

No.	Year	Total
1	2019	13
2	2020	6
3	2021	9
4	2022	15
5	2023	6
6	2024	1
		50

The publication trend shows significant fluctuations from year to year. In 2019, the number of publications reached 13, reflecting the high interest in this topic. However, this figure dropped sharply in 2020 to 6 publications, most likely influenced by the disruption caused by the COVID-19 pandemic. The year

2021 saw a slight recovery with 9 publications, indicating that interest is starting to recover. The biggest spike occurred in 2022 with 15 publications, indicating a strong return of attention to the issue of electronic medical records. In contrast, 2023 saw another drop to 6 publications, which may reflect

fluctuations in research interest or changing trends. The data for 2024 shows only one publication, which may not yet reflect the full volume

of publications this year, or could indicate a decline in research activity in this topic.

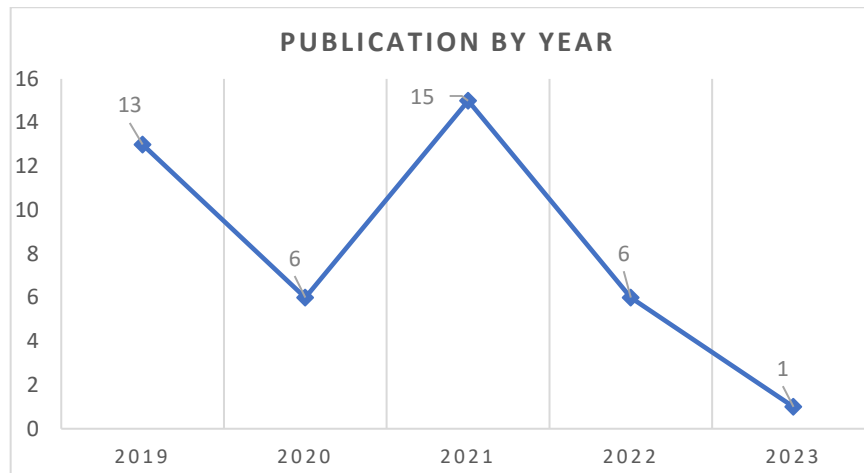


Figure 1. Related Publication Trends from Google Schollar databases using PoP application

These fluctuations can be influenced by various factors such as changing research priorities, the impact of the pandemic, and the publication process that takes time. Overall, the data shows significant fluctuations in the number of publications each year. Some factors that may have influenced these fluctuations include:

1. COVID-19 pandemic: As seen in the sharp drop in 2020, the pandemic may affect research priorities and resource allocation.
2. Changing Research Interests: Academic research often follows changing trends and interests, which can lead to fluctuations in the number of publications.
3. Publication Process: Academic publications often take a considerable amount of time from writing to publishing, so

the 2024 figures may not fully reflect the actual volume of publications.

Publication Trends by Country

In evaluating related publication trends, it is interesting to see how research contributions vary across countries. This research is important as it reflects how different parts of the world are addressing and developing electronic medical record systems, which are a crucial component in modern healthcare systems.

Looking at the publication data by country, the United States emerged as the leader with 16 publications, confirming the country's significant role in health technology research and electronic medical record system innovation. This reflects the country's abundant research resources and deep focus in this area.



Figure 2. Distribution Of Countries That Publish Related Research

Table 2. List Of Journal Publishers By Country

No.	Country	Total
1	Indonesia	4
2	South Africa	7
3	China	2
4	US	16
5	Brazil	3
6	Kenya	2
7	Bangladesh	1
8	Portugal	2
9	Netherlands	3
10	China	2
11	Malaysia	1
12	Turkkey	1
13	East Africa	1
14	Lebanon	1
15	Iran	1
16	Italian	1
17	Switzerland	1
18	United Kingdom	1
		50

South Africa followed, with 7 publications, demonstrating a strong commitment in Africa to improving quality and compliance in electronic medical record systems. This reflects the local need to improve health systems in the region. Indonesia and Brazil, each with 4 publications, show active engagement from developing

countries in addressing challenges related to electronic medical records, indicating significant efforts to develop and implement more effective systems in their contexts. China, despite being a major technological power, only contributed with 2 publications, which may indicate differences in

research focus or challenges in publication.

Contributions from countries such as Kenya, Portugal, and the Netherlands with 2-3 publications each reflect the growing interest at the local level, while countries with one publication, such as Bangladesh, Malaysia, Turkey, East Africa, Lebanon, Iran, Italy, Switzerland, and the UK, offer additional perspectives that while limited, are nonetheless important.

This analysis reveals that the United States and South Africa lead the way in this research, while contributions from other countries provide an overview of the global distribution and key centers of innovation in the field of electronic medical records. By understanding the countries most active in this research, we can identify centers of innovation and health policies that may influence the development and adoption of electronic medical record technology. This analysis also helps identify patterns and trends in global research contributions, which can be used to inform development strategies and international collaboration in improving electronic medical record systems. In addition, an understanding of the contributions from different

countries can aid in policy planning and more effective resource allocation for research and development in this area.

Journal Distribution

The distribution by type of journal published shows interesting variations. Research Articles dominate with 41 publications, signaling that most research is presented in the form of original research articles featuring the results of empirical studies and recent data. Meanwhile, Literature Review appears with 4 publications, reflecting an interest in summarizing and analyzing existing knowledge to identify trends and gaps in the field. Book, with 3 publications, shows an attempt to compile an in-depth and comprehensive analysis of this topic in a book format. Conference, with 2 publications, shows contributions from presentations and discussions presented in conference forums, providing an early overview of the latest research and innovations. Overall, these different types of publications reflect different approaches to disseminating knowledge about electronic medical records, from empirical studies to literature reviews and comprehensive resources.

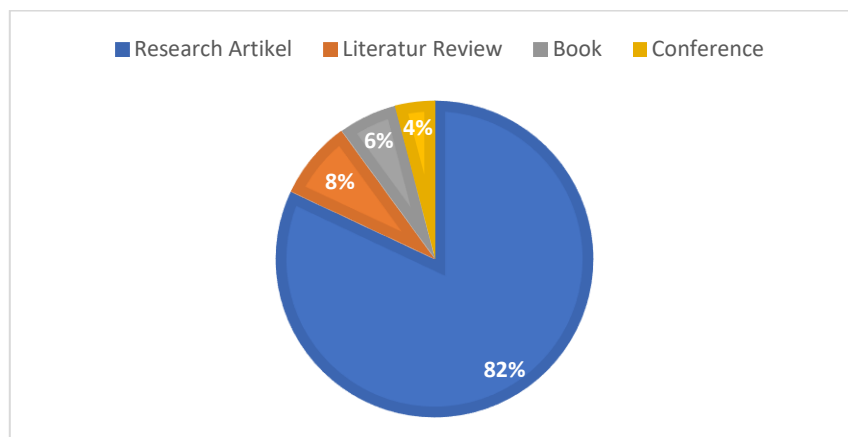


Figure 3. Types of Publications

For future research, it is important to expand the focus from empirical research to less common forms of publication, such as literature reviews and books, to gain a broader and more in-depth view of electronic medical records. Conference research could also be enhanced, as these forums often feature the latest innovations and important early findings. In addition, future research could explore the topic with a multi-disciplinary approach, combining results from

different types of publications to provide a more comprehensive picture of the challenges and solutions in electronic medical record filling. This approach will not only enrich the existing literature but also help in formulating better policies and practices in the future electronic health system.

Discussion of Analysis Results Based on Network Visualization Publication Overview

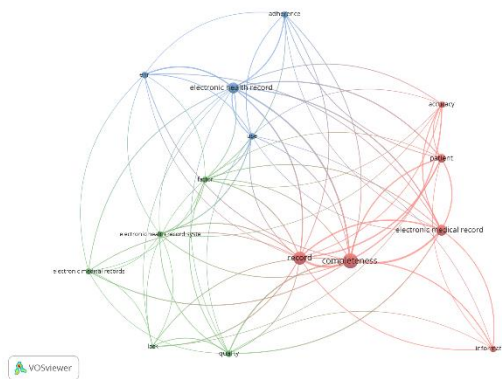


Figure 4. Network Visualization Overview Publications

In the publication network visualization using VOSviewer, there are three main clusters that illustrate the research focus in this study:

1. Cluster 1 includes “accuracy,” “completeness,” “electronic medical record,” “information,” “patient,” and “record.” This cluster emphasizes the importance of accuracy and completeness in electronic medical records and their impact on the quality of patient information and medical record systems. Research in this cluster often explores how the accuracy of medical record data affects patient health outcomes and

the operational efficiency of health systems.

2. Cluster 2 focuses on “electronic health record system,” “electronic medical record,” “factors,” “lack,” and “quality.” This cluster explores the various factors that influence the quality of electronic health record systems as well as challenges related to deficiencies in the implementation of such systems. Research in this cluster typically addresses issues such as feature deficiencies, system integration, and factors that hinder the effectiveness of electronic medical record systems.

3. Cluster 3 consists of “adherence,” “EHR,” “electronic health record,” and “use.” This cluster highlights adherence to the use of EHR systems and how the implementation of this technology in daily practice affects medical record filling. Research in this cluster often focuses on how factors such as training, policy, and motivation affect the rate of adoption and use of EHR systems among healthcare workers.

For future research, the findings from this analysis can be used to delve deeper into how the three clusters are interconnected. For example, further investigation could explore how improving data accuracy and completeness (Cluster 1) could influence system quality and address identified deficiencies in implementation (Cluster 2). In addition, understanding the factors that influence adherence and use of EHR systems (Cluster 3) may provide practical guidance to improve medical record completion and overall system quality. Integrating insights from these three areas will help develop a more holistic strategy to improve the effectiveness and efficiency of electronic medical record systems.

Discussion of Analysis Results Based on Overlay Visualization Publications

The Overlay Visualization illustrates how the frequency and focus of publications change over time by associating color or intensity with the year of publication. In the overlay visualization, we can see some key patterns:

1. Upward and Downward Trends: If certain areas of the visualization show brighter colors in certain years, this

indicates an increase in the number of publications in that topic. For example, if there are more intense colors in certain clusters in recent years, this may signify increased interest or greater attention to certain aspects of electronic medical records, such as data accuracy or compliance with EHR systems. Conversely, areas with fading colors indicate decreased interest or publications in that aspect.

2. New Topic Emergence: Emerging colors or increased intensity in certain areas may signal the emergence of new topics or emerging trends. For example, if clusters that were initially underrepresented start to get more publications over time, this could indicate that the topic is becoming more relevant or gaining greater attention from the research community. Change in Research Focus: Overlay visualizations can also show shifts in focus in research over time. For example, if early publications focused more on “accuracy” and “completeness” (Cluster 1) but later shifted to issues related to “quality” and “factors” (Cluster 2), this reflects a change in research attention and priorities, perhaps due to advances in technology or changes in the challenges faced.
3. Collaboration and Interdisciplinary Patterns: Overlay visualizations can also reveal patterns of collaboration between different topics or disciplines. If some clusters begin to show clearer linkages over time, this could signal integration

between previously separate areas of research, such as

between data accuracy and compliance with EHR systems.

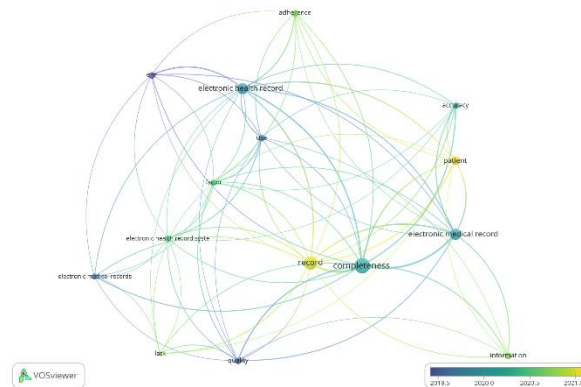


Figure 5. Overlay Visualization Overview Publications

In conclusion, this overlay visualization of publications provides a dynamic picture of how electronic medical record-related topics evolve over time. It helps researchers to understand historical trends, identify up-and-coming topics, and assess how the focus of research has changed, as well as direct future research efforts by identifying areas that need further attention.

Discussion of Analysis Results Based on Publication Density Visualization

The discussion on Density Visualization of publications in the study on “Completeness of Electronic Health and Medical Record Filling by Health Workers” offers insight into the concentration and density of research in various topics related to electronic medical

records. The Density Visualization provides an overview of areas with a high frequency of publications and shows how dense or concentrated the research is within a particular area. In the Density Visualization, some key points to note are:

1. **Publication Density:** Areas with darker or more intense colors indicate a higher concentration of publications. This indicates that there is a lot of research focused on a particular topic. For example, if the cluster related to “accuracy” and “completeness” (Cluster 1) shows high density, this means that many studies highlight the importance of accuracy and completeness in electronic medical records.

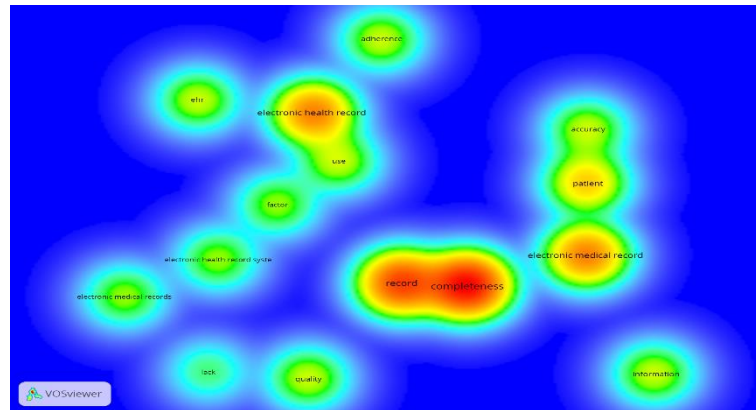


Figure 6. Density Visualization Overview Publications

2. Major Research Centers: Density Visualization helps identify the main centers of research in the field. Areas with a high concentration of publications often indicate the main focus or most researched areas, such as electronic medical record systems as a whole or factors affecting data quality.
3. Less Researched Areas: Conversely, areas with a lighter color or low density indicate that the topic may have received less attention from the research community. For example, if “adherence” and “use” (Cluster 3) show lower density, this could indicate that studies on adherence and use of EHR systems may still lack exploration compared to other topics.
4. Correlations and Linkages: Density Visualization also reveals relationships between different topics. High-density areas that are close to each other indicate that research within those areas are often interrelated. For example, if the related topics “quality” and “factors” (Cluster 2) have a high density near “accuracy” and “completeness” (Cluster 1), this indicates that studies on system quality often focus on factors that affect data accuracy and completeness.

In conclusion, Density Visualization provides a clear picture of the concentration of research in different aspects of electronic medical records. It helps researchers to identify areas of high research focus as well as recognize topics that may require more exploration. By understanding the density of publications, researchers can determine key areas for further development and evaluate how various topics are interrelated in the scientific literature.

CONCLUSIONS

This study provides a comprehensive overview of research trends related to the completion of electronic medical record filling by health workers using bibliometric analysis. The analysis showed that there was a significant increase in the volume of publications from 2019 to 2022, with a peak in 2022, signaling a growing interest in this topic. The main contributors to the research were the United States and South Africa, while other countries such as Indonesia and Brazil also showed significant activity in this area.

The main clusters identified include a focus on medical record accuracy and completeness, factors affecting system quality, and compliance with the use of EHR

systems. Findings from the overlay and density visualizations suggest that while there is increased attention to system quality and compliance, there are still areas that are less explored, particularly in relation to factors that influence the implementation and effective use of EHR systems.

Overall, this analysis highlights the importance of understanding the dynamics of research in the field of electronic medical records and provides insights into areas that require further attention. Future research is expected to address the existing gaps by exploring more deeply the under-explored aspects and integrating findings from various clusters to improve the effectiveness of electronic medical record systems and the quality of data entry by health workers. Integration of findings from different topics will be valuable to develop more holistic and effective solutions in EHR systems.

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