

Bibliometric Insights into the Evolution of Health Information Systems and Telemedicine Research

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ABSTRACT

This bibliometric study provides a comprehensive analysis of the research landscape in Health Information Systems (HIS) and Telemedicine, elucidating key trends, influential factors, and thematic clusters shaping the field's evolution. Through systematic data collection and analysis of nearly a thousand scholarly articles, this research offers insights into publication output, citation patterns, collaboration networks, and thematic areas within HIS and Telemedicine research. Thematic network and temporal analyses reveal distinct clusters focusing on telehealth, HIS implementation, advanced telemedicine technologies, and contextual factors influencing telemedicine adoption. Highly cited papers and author collaboration networks further underscore seminal contributions and research clusters within the field. Overall, this study contributes to a deeper understanding of the current state of HIS and Telemedicine research, informing strategic initiatives for future advancements in healthcare technology and delivery.

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1. INTRODUCTION

The integration of technology into healthcare systems has revolutionized the way medical information is managed and utilized [1]. Health Information Systems (HIS) utilize sophisticated information technology tools to efficiently collect, store, and disseminate healthcare data [2]. This not only streamlines administrative processes but also facilitates seamless communication among healthcare professionals, enabling swift access to patient records and collaborative decision-making [3], [4]. Moreover, HIS platforms are designed to enhance patient care by providing clinicians with comprehensive and up-to-date

medical information, leading to more accurate diagnoses and personalized treatment plans [4].

Telemedicine represents a groundbreaking application of telecommunications technology in healthcare delivery [5]. By leveraging digital communication channels, telemedicine enables healthcare providers to offer clinical services remotely, overcoming geographical barriers and improving healthcare accessibility, especially in underserved areas [6], [7]. Through virtual consultations, remote monitoring, and telehealth platforms, patients can receive timely medical advice and intervention without the need for physical

visits to healthcare facilities [8]. This not only saves time and resources but also empowers patients to take a more proactive role in managing their health [9].

The synergy between Health Information Systems and Telemedicine holds immense potential for transforming healthcare delivery on a global scale [10]. Integrated HIS platforms can seamlessly incorporate telemedicine functionalities, allowing for the efficient exchange of patient data and real-time communication between healthcare providers and patients [11]. This integration enhances care coordination, reduces medical errors, and improves patient outcomes by ensuring continuity of care across different care settings [12], [13]. Furthermore, the adoption of telemedicine within HIS frameworks enables healthcare organizations to optimize resource allocation, minimize healthcare disparities, and adapt to evolving patient needs and preferences [14].

The rapid evolution of technology and its applications in healthcare present a dynamic research landscape in Health Information Systems and Telemedicine. However, there is a lack of comprehensive analysis regarding the trajectory of research in this domain. Identifying the gaps, trends, and influential factors shaping HIS and Telemedicine research can facilitate a deeper understanding of the field's progression and inform strategic initiatives for future advancements. The primary objective of this research is to conduct a bibliometric analysis of the literature pertaining to Health Information Systems and Telemedicine. Specifically, the study aims to: (1) Identify the key thematic areas and research trends within Health Information Systems and Telemedicine. (2) Analyze the publication output, citation patterns, and collaboration networks among researchers and institutions. (3) Investigate the influence of technological advancements, policy frameworks, and socioeconomic factors on the evolution of HIS and Telemedicine research.

2. LITERATURE REVIEW

2.1 Health Information Systems

Health Information Systems (HIS) are complex entities that play a crucial role in guiding public health policies and programs. These systems consist of diverse components that interact and depend on each other. The goal of HIS is to provide reliable and timely information for decision-making. HIS should be flexible, adaptable, and use new technologies to improve existing systems. Data and findings from HIS should be rigorously analyzed, interpreted, translated, disseminated, and used to inform implementation. Good leadership and governance are essential for the effective use of HIS, as they influence the culture of data use and evidence-based decision making. The use of HIS as accountability tools can enhance local accountability practices and improve health care delivery. Health Management Information Systems (HMIS) are a key component of HIS and involve various processes, subsystems, and data sources. Computer technology plays a vital role in designing and implementing HMIS. Data quality, integration, and integrity are crucial considerations in HIS implementation. [15]–[19]

2.2 Telemedicine

Telemedicine is an emerging healthcare delivery model that uses information and communication technologies (ICTs) to provide medical services remotely. It has the potential to improve healthcare outcomes, particularly in resource-limited settings, by improving patient access to medical care, reducing healthcare costs, and increasing patient satisfaction [20]. Telemedicine is the use of computers and automated data to deliver technologies and promote healthcare when patients are located far away

from professionals [21]–[23]. It cannot replace old-fashioned medicine everywhere, especially in emergency medicine, but it offers opportunities for medical education and training, remote consultations and diagnoses, and remote patient health status monitoring [24]. The use of telemedicine, especially during crises like the Covid-19 pandemic, has the potential to deliver accessible, affordable, and effective healthcare services worldwide [24]. It overcomes distance as a critical factor by using communication and information technologies, improving access to healthcare and complementing healthcare itself. Continued research and innovation are needed to ensure the success and sustainability of telemedicine as a healthcare delivery model.

3. METHODS

The research will involve systematic data collection from academic databases such as PubMed, Scopus, Web of Science, and Google Scholar. Keywords related to Health Information Systems, Telemedicine, and related terms will be used to retrieve relevant articles published within a specified time frame. Articles included in the analysis will be peer-reviewed research papers, conference proceedings, and review articles focusing on Health Information Systems, Telemedicine, or related topics. The inclusion criteria will encompass studies published in English and within a defined time period to capture recent trends in the field. A bibliometric analysis will be conducted to quantitatively assess the characteristics of the retrieved literature. Key bibliometric indicators such as publication counts, citation counts, collaboration patterns, and geographic distribution will be analyzed using bibliometric software tool such as VOSviewer.

4. RESULT AND DISCUSSION

Table 1. Research Data Metrics

Metrics Data	Information
Publication years	1976-2024
Citation years	48
Papers	980
Citations	34699
Cites/year	722,90
Cites/paper	35,41
Authors/paper	2,53
h-index	91
g-index	167
hI,norm	59
hI,annual	1,23
hA, index	24
Papers with ACC \geq	1,2,5,10,20: 451,313,169,81,32

Source: Output Publish or Perish, 2024

Table 1 provides comprehensive metrics summarizing the research data analyzed in this study on Health Information Systems and Telemedicine. The data covers publication years from 1976 to 2024, spanning a period of 48 citation years. A total of 980 papers were included in the analysis, accumulating a substantial number of citations totaling 34,699. On average, the research received approximately 722.90 citations per year, reflecting the impact and relevance of the literature in this field. Each paper garnered an average of 35.41 citations, highlighting the influence of individual contributions. Collaboration was common, with an average of 2.53 authors per paper. The h-index, a widely used metric to assess research impact, stood at 91, indicating that 91 papers in the dataset received at least 91 citations each. The g-index, a variation of the h-index, was calculated at 167, providing another measure of research productivity and impact. The hI,norm and hI,annual metrics offer normalized measures of the h-index, accounting for variations in citation practices over time. Additionally, the hA index, which accounts for author order, was calculated at 24, indicating the contribution of prolific authors to the field. Furthermore, the table provides insights into the distribution of highly cited papers, with 451 papers having an accumulated citation count of at least 1, 313

papers with a count of at least 2, and so forth, up to 32 papers with a count of at least 20, underscoring the presence of influential works in the literature. These metrics offer a comprehensive overview of the research landscape in Health Information Systems and Telemedicine, highlighting its impact, productivity, and collaborative nature.

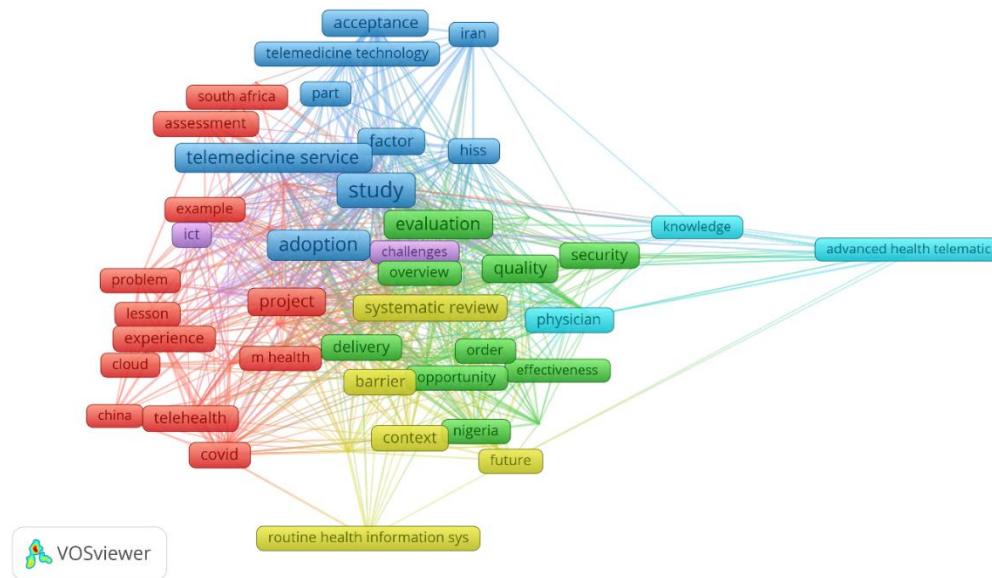


Figure 1. Thematic Network Analysis
Source: Data Analysis Result, 2024

In this network, each node (the colored rectangle) represents a key term or concept, and the lines between them indicate the strength of the relationship or association between these terms. The thickness of the lines might signify the frequency of association or the strength of the relationships in the underlying data (e.g., the number of times two terms appear together in literature). The visualization also seems to involve a color-coding scheme to group related terms into clusters, suggesting thematic clusterization. This is often done to show how different terms or concepts are grouped together in the literature, indicating different themes or focal areas of research.

1. Red Cluster: This seems to focus on telehealth, particularly in the context of COVID. It includes terms like 'problem', 'lesson', 'experience', 'cloud', and 'China', suggesting a discussion of the challenges and

lessons learned from using telehealth services during the pandemic, possibly with a focus on experiences in China.

2. Green Cluster: This group relates to the implementation and adoption of health information systems ('hiss'), with terms like 'adoption', 'barriers', 'opportunity', and 'delivery'. 'Nigeria' is also present, indicating that some of the literature may be focusing on this geographic area.
3. Blue Cluster: Terms like 'advanced health telematic', 'knowledge', 'security', 'quality', and 'physician' suggest a focus on advanced telemedicine technologies, issues of data security, quality of care, and the knowledge required for effective use. This may indicate a cluster about the technological and professional aspects of telemedicine.

emerging trends, gaps in the research, and potential future directions.

Table 2. Most Cited Article

Citations	Author and Year	Title
1366	[25]	Effectiveness of Telemedicine: A Systematic Review of Reviews
1216	[17]	Health Information Systems-Past, Present, Future
1039	[16]	Health Information Systems: Failure, Success, and Improvisation
964	[26]	Cognitive and Usability Engineering Methods for the Evaluation of Clinical Information Systems
939	[27]	An Evaluation Framework for Health Information Systems: Human, Organization, and Technology -Fit Factors
726	[28]	Mobile Health (mHealth) Approaches and Lessons for Increased Performance and Retention of Community Health Workers in Low and Middle Income Countries
693	[21]	Investigating Acceptance of Telemedicine Services through an Extended Technology Acceptance Model (TAM)
684	[20]	The Digitalization of Healthcare: Boundary Risks, Emotion, and Consumer Willingness to Disclose Personal Health Information
660	[15]	Evaluation of Health Information Systems-Problems and Challenges
563	[18]	Privacy, Information Technology, and Health Care

Source: Output Publish or Perish, 2024

The table presents a selection of highly cited papers within the field of Health Information Systems and Telemedicine, along with their respective citation counts and publication details. Topping the list is "Effectiveness of Telemedicine: A Systematic Review of Reviews" by AG Ekeland, A Bowes, and S Flottorp, with 1366 citations, indicating its significant influence in the literature. Other notable contributions include "Health Information Systems-Past, Present, Future" by R Haux, "Health Information Systems: Failure, Success, and Improvisation" by R Heeks, and "Cognitive and Usability Engineering Methods for the Evaluation of Clinical Information Systems" by AW Kushniruk, each with substantial citation counts reflecting their impact on the field. Additionally, papers such as "An Evaluation Framework for Health Information Systems:

Human, Organization, and Technology -Fit Factors" by MM Yusof et al., "Mobile Health (mHealth) Approaches and Lessons for Increased Performance and Retention of Community Health Workers in Low and Middle-Income Countries" by K Kallander et al., and "Investigating Acceptance of Telemedicine Services through an Extended Technology Acceptance Model (TAM)" by SA Kamal et al. are also highly cited, underscoring their importance in the discourse on healthcare technology adoption and usability. These papers cover a range of topics including telemedicine effectiveness, evaluation frameworks, mobile health approaches, privacy concerns, and technology acceptance models, collectively contributing to the advancement of research and practice in Health Information Systems and Telemedicine.

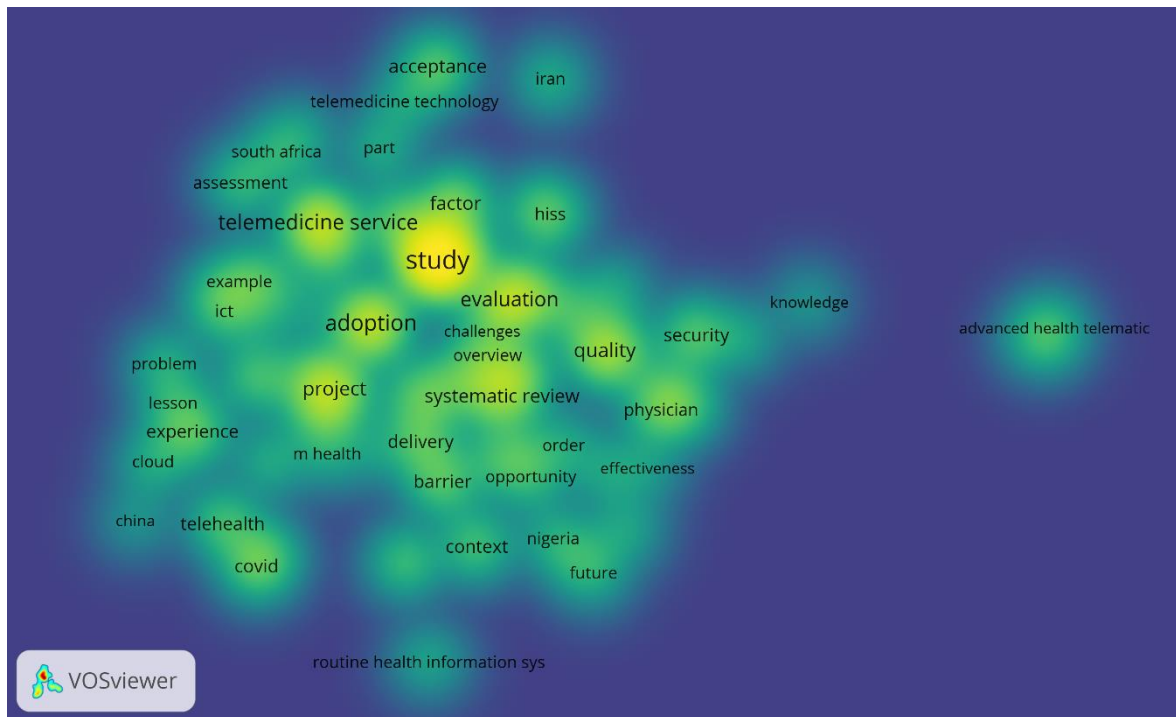


Figure 3. Density Visualization
 Source: Data Analysis Result, 2024

In the context of this visualization, the areas that are less bright likely represent keywords or topics that are currently less prominent or developed in the research literature but could be potential areas for future research. The less bright area contains keywords such as: "advanced health telematic", "knowledge", "security", "physician", "effectiveness", "nigeria", "future". This suggests a potential research topic in the future could focus on the development and effectiveness of advanced health telematic systems, with an emphasis on security and physician involvement. Furthermore, the mention of Nigeria implies

that there is room for country-specific studies, examining the future of health telematics in the context of Nigeria or similar regions. Research could explore how these systems can be optimized to improve healthcare delivery, ensure data security, and be effectively used by healthcare professionals. The need for such research might be driven by ongoing technological advancements and the continuous evolution of healthcare needs, especially in developing countries or regions with unique challenges.

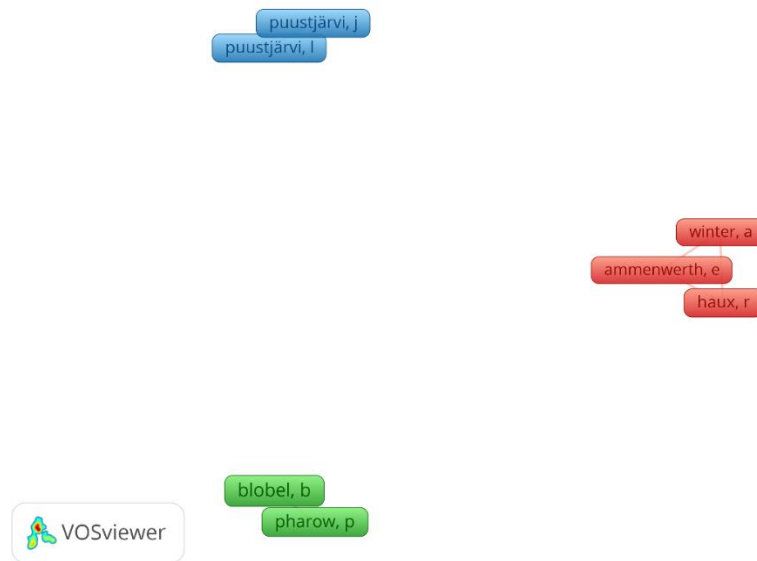


Figure 4. Author Collaboration
Source: Data Analysis Result, 2024

The visualization uses different colors to potentially indicate different clusters or groups of researchers that are more closely associated with each other than with those in other clusters. The image shows three distinct clusters: blue, red, and green. The blue cluster, with authors "Puustjärvi, J" and "Puustjärvi, L", indicates that these authors are linked, possibly through co-authorship or subject matter. The red cluster with "Winter, A", "Ammenwerth, E", and "Haux, R", and the green cluster with "Blobel, B" and "Pharow, P", suggest these authors are similarly connected. The last one is the green cluster consist of "blobel,b" "pharow,p".

5. CONCLUSION

In conclusion, the bibliometric analysis of the literature on Health Information Systems (HIS) and Telemedicine provides valuable insights into the evolution and trends of research in this dynamic field.

The comprehensive metrics reveal a robust body of literature with a significant impact, as evidenced by the high citation counts and collaborative nature of the research. The thematic network analysis highlights key areas of focus, including telehealth, HIS implementation, advanced telemedicine technologies, and contextual factors influencing telemedicine adoption. Moreover, the temporal analysis underscores the evolution of research priorities over time, reflecting shifts in technological advancements and emerging healthcare challenges. The identification of highly cited papers and author collaboration networks further elucidates seminal contributions and key research clusters within the field. Overall, this analysis not only contributes to a deeper understanding of the current state of HIS and Telemedicine research but also informs future directions for advancing healthcare technology and delivery on a global scale.

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