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Exploring The Challenges And Advantages Of Electronic Health File Systems: A Systematic Review

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Abstract

Background: Electronic Health Records (EHRs) play a crucial role in modern healthcare by providing a digital repository for patient information. However, the adoption and optimization of EHR systems present various challenges to healthcare organizations. Understanding these challenges and potential solutions is essential for improving the efficiency and effectiveness of EHR utilization.

Aim: This study aims to comprehensively examine the challenges and potential solutions related to Electronic Health Record (EHR) utilization in healthcare settings. **Method:** A systematic review of existing literature was conducted to identify key themes and trends in EHR research. 10 studies focusing on challenges, solutions, and best practices for EHR utilization were included in the analysis.

Results: The study identified several common challenges faced by healthcare organizations in EHR utilization, including issues related to data quality, usability, privacy, interoperability, and adoption. Various potential solutions, such as the adoption of emerging technologies like block chain and data mining, were also discussed.

Conclusion: Electronic Health Records (EHRs) offer immense potential for improving patient care and healthcare delivery. However, the challenges associated with EHR utilization must be addressed to maximize their benefits. Collaborative efforts between policymakers, healthcare providers, and technology vendors are essential to overcome these challenges and optimize EHR utilization.

Keywords: Electronic Health Records (EHRs), healthcare technology, data quality, usability, privacy, interoperability, adoption, block chain, data mining.

Introduction

Electronic Health Record (EHR) systems have emerged as a cornerstone of modern healthcare, offering a digital platform for storing, managing, and sharing patient information across various healthcare settings (Mahajan et al., 2022). The adoption of EHR systems has been driven by the promise of improved patient care, enhanced care coordination, and increased operational efficiency (Parameshwari et al., 2022). However, as healthcare organizations transition from paper-based records to electronic systems, they encounter a myriad of challenges and opportunities inherent in this digital transformation (Shaikh et al., 2022). Understanding these challenges and advantages is essential for optimizing the implementation and utilization of EHR systems in healthcare delivery. (Alruwaili et al., 2023).

One of the primary challenges in the adoption of EHR systems is interoperability, or the ability of different systems to exchange and use data seamlessly. Interoperability gaps can lead to fragmented patient records, hindering care coordination and compromising patient safety (Zheng et al., 2020). Moreover, ensuring the security and privacy of electronic health files presents a significant concern, as healthcare data is increasingly targeted by

cyber threats (Nakajjubi et al., 2022). Robust data security measures, such as encryption and access controls, are essential for safeguarding patient information and maintaining compliance with healthcare regulations (Marwaha et al., 2022).

User interface design also plays a critical role in the usability and effectiveness of EHR systems. Poorly designed interfaces can impede workflow efficiency and contribute to user frustration, potentially compromising the quality of patient care (Nautiyal et al., 2023). Additionally, the implementation costs associated with acquiring and maintaining EHR systems can be substantial, particularly for small healthcare practices with limited resources (Puneeth & Parthasarathy, 2023). Overcoming these financial barriers requires careful planning and consideration of long-term return on investment (Verdonck & Poels, 2020).

Despite these challenges, EHR systems offer a range of advantages that can significantly enhance healthcare delivery (Rui et al., 2023). Improved access to patient information enables healthcare providers to make more informed clinical decisions and deliver more personalized care. Furthermore, EHR systems facilitate communication and collaboration among members of the healthcare team, leading to better care coordination and improved patient outcomes (Deepa & Arya, 2022). Clinical decision support tools integrated into EHR systems provide real-time guidance to healthcare providers, helping to reduce medical errors and improve patient safety (Perugu et al., 2022).

Moreover, EHR systems have the potential to enhance efficiency and productivity in healthcare settings. Features such as electronic prescribing, automated reminders, and streamlined documentation workflows streamline administrative tasks and allow healthcare providers to focus more time on patient care (Kaihlanen et al., 2022). Additionally, the data generated by EHR systems can be leveraged for analytics purposes, enabling healthcare organizations to identify trends, monitor population health metrics, and optimize resource allocation (Murala et al., 2023). This data-driven approach has the potential to transform healthcare delivery by enabling more proactive and personalized care (Girolami et al., 2022).

While electronic health file systems present numerous challenges, such as interoperability, data security, usability, and cost, they also offer significant advantages in terms of improved

access to patient information, enhanced communication, clinical decision support, and efficiency gains. (Mishra et al., 2023). Understanding and addressing these challenges and advantages are essential for realizing the full potential of EHR systems in transforming healthcare delivery and improving patient outcomes.

Significant of Study

This systematic review on the challenges and advantages of electronic health file systems is of paramount significance in guiding healthcare organizations, policymakers, and technology developers toward informed decision-making and strategic planning (Dinesh & Indrajith, 2023). By synthesizing existing literature, this study sheds light on the multifaceted landscape of EHR implementation, addressing critical issues such as interoperability, data security, usability, and cost-effectiveness. Its findings provide valuable insights into the opportunities and barriers associated with EHR adoption, enabling stakeholders to formulate evidence-based strategies for optimizing the implementation and utilization of electronic health record systems. Ultimately, this research contributes to the advancement of healthcare delivery by facilitating the realization of the full potential of EHR systems in improving patient care, enhancing care coordination, and driving operational efficiency.

Aim of Study

The aim of this systematic review is to comprehensively examine the challenges and advantages inherent in electronic health file systems. By synthesizing existing literature, the study seeks to identify key barriers and opportunities associated with the implementation and utilization of electronic health record (EHR) systems in healthcare delivery. Through a rigorous analysis of factors such as interoperability, data security, usability, and cost-effectiveness, the research aims to provide valuable insights to inform evidence-based decision-making and strategic planning for healthcare organizations, policymakers, and technology developers. Ultimately, the study aims to contribute to the advancement of healthcare delivery by facilitating the optimization of EHR systems to improve patient care, enhance care coordination, and drive operational efficiency.

Objective

1. To systematically identify and analyze challenges such as interoperability issues, data security concerns, usability barriers, and cost implications in electronic health file systems.
2. To critically evaluate advantages including improved access to patient information enhanced communication and collaboration, clinical decision support capabilities, and efficiency gains in electronic health file systems.

Method

Identification of Research question

The research question driving the present systematic review revolves around comprehensively exploring the challenges and advantages associated with electronic health file systems (Al-Kaabi & Abdullah, 2023). This inquiry seeks to delve into the complexities surrounding the implementation and utilization of electronic health record (EHR) systems in healthcare settings. By synthesizing existing literature and analyzing factors such as interoperability, data security, usability, and cost-effectiveness, the study aims to address overarching questions regarding the obstacles hindering effective EHR implementation and the potential benefits these systems offer in optimizing healthcare delivery. Ultimately, the research question aims to provide insights that can inform evidence-based decision-making and strategic planning for healthcare organizations, policymakers, and technology developers, contributing to the advancement of healthcare delivery and improved patient outcomes.

Research question	In healthcare settings (P), does the adoption of electronic health file systems (I) compared to traditional paper-based or alternative electronic record-keeping systems (C) affect challenges and advantages such as interoperability, data security, usability, cost-effectiveness, access to patient information, communication, clinical decision support,

		and efficiency (O) within the present and recent past perspectives (T)??
P	**Population**	Healthcare professionals and organizations implementing or considering electronic health record (EHR) systems.
I	**Intervention**	Adoption and utilization of electronic health file systems.
C	**Comparison**	Traditional paper-based record-keeping systems or alternative electronic record systems.
O	**Outcome**	Assessment of challenges and advantages associated with electronic health file systems, including interoperability, data security, usability, cost-effectiveness, improved access to patient information, enhanced communication and collaboration, clinical decision support capabilities, and efficiency gains.
T	**Timeframe**	Over a specified period OF 2019 - 2023, reflecting current perspectives and trends in EHR implementation and utilization.

What are the challenges and advantages associated with electronic health file systems compared to traditional paper-based or alternative electronic record-keeping systems in healthcare settings?

Explanation: The research question driving this systematic review focuses on comprehensively exploring the challenges and advantages of electronic health file systems relative to traditional paper-based or alternative electronic record-keeping systems in healthcare settings. It aims to delve into the complexities surrounding the implementation and utilization of electronic health record (EHR) systems, synthesizing existing literature and analyzing factors such as interoperability, data security, usability, and cost-effectiveness. By addressing overarching questions about the obstacles hindering effective EHR implementation and the potential benefits these systems offer in optimizing healthcare delivery, the study aims to inform evidence-based decision-making

and strategic planning for healthcare organizations, policymakers, and technology developers. Ultimately, it contributes to the advancement of healthcare delivery and improved patient outcomes.

Selection Criteria

Inclusion Criteria

- Research conducted within the past five years (2019-2023).
- Studies focusing on electronic health record (EHR) systems and electronic health file systems.
- Research exploring challenges and advantages associated with EHR implementation and utilization.
- Studies examining factors such as interoperability, data security, usability, and cost-effectiveness of electronic health file systems.
- Research assessing the impact of electronic health files systems on access to patient information, communication, clinical decision support, and efficiency in healthcare settings.

Exclusion Criteria

- Studies conducted outside the specified timeframe of 2019-2023.
- Research not specifically related to electronic health record (EHR) systems or electronic health file systems.
- Studies unrelated to challenges and advantages associated with EHR implementation and utilization.
- Research focusing solely on technical aspects of EHR systems without addressing broader implications for healthcare delivery.
- Studies not examining factors such as interoperability, data security, usability, or cost-effectiveness of electronic health file systems.
- Research not assessing the impact of electronic health files systems on access to patient information, communication, clinical decision support, or efficiency in healthcare settings.

Database Selection

For the systematic review on exploring the challenges and advantages of electronic health file systems, a thorough search was conducted across multiple academic databases, including PubMed, Scopus, Web of Science, and Google Scholar. The search strategy incorporated keywords related to electronic health record (EHR) systems, encompassing aspects such as implementation challenges ("EHR implementation"), interoperability ("Interoperability"), data security ("Data security"), usability ("Usability"), cost-effectiveness ("Cost-effectiveness"), access to patient information ("Access to patient information"), communication ("Communication in healthcare"), clinical decision support ("Clinical decision support"), and efficiency in healthcare ("Efficiency in healthcare"). Additionally, terms representing healthcare professionals ("Healthcare professionals," "Medical staff," "Nurses," "Physicians," "Health information managers," "Health informaticians") were included. Boolean operators were utilized to combine these terms effectively, narrowing the search to relevant studies. Geographical focus was incorporated as needed, with a particular interest in studies conducted within the past five years (2019-2023). The search aimed to provide a comprehensive analysis of the obstacles and benefits associated with electronic health file systems, informing evidence-based decision-making and strategic planning for healthcare stakeholders.

Data Extracted

Data were extracted from the four selected databases, namely PubMed, Scopus, Web of Science, and Google Scholar, using the four syntaxes identified for the search. Syntax 1 focused on terms related to electronic health record (EHR) systems, Syntax 2 emphasized geographical relevance, Syntax 3 targeted healthcare professionals' perspectives, and Syntax 4 included specific terms for outcomes or other relevant factors. Each syntax was applied systematically to ensure comprehensive coverage of the literature. The extracted data encompassed studies conducted within the specified timeframe (2019-2023) and provided insights into the challenges and advantages associated with electronic health file systems, contributing to the systematic review's objectives.

Syntax

Syntax 1	"Electronic health record systems" OR "Electronic health file systems" OR "EHR implementation" OR "EHR challenges" OR "EHR advantages" OR "Interoperability" OR "Data security" OR "Usability" OR "Cost-effectiveness" OR "Access to patient information" OR "Communication in healthcare" OR "Clinical decision support" OR "Efficiency in healthcare"
Syntax 2	"Healthcare professionals" OR "Medical staff" OR "Nurses" OR "Physicians" OR "Health information managers" OR "Health informaticians
Syntax 3	Patient outcomes" OR "Healthcare system resilience

In the study, four syntaxes were employed to systematically search for relevant literature on electronic health file systems. Syntax 1 encompassed keywords related to electronic health record (EHR) systems, including implementation challenges and advantages, interoperability, data security, usability, cost-effectiveness, access to patient information, communication, clinical decision support, and efficiency in healthcare. Syntax 2 targeted perspectives of healthcare professionals, incorporating terms such as medical staff, nurses, physicians, health information managers, and health informaticians. Finally, Syntax 3 included specific terms related to outcomes or other relevant factors, such as patient outcomes and healthcare system resilience. These syntaxes were systematically applied to ensure comprehensive coverage of the literature and to address various aspects of electronic health file systems within the study's scope.

Literature Search

For the present study, a comprehensive literature search was conducted across major academic databases, including PubMed, Scopus, Web of Science, and Google Scholar. Keywords related to electronic health record (EHR) systems were systematically employed to retrieve relevant studies addressing challenges and advantages associated with electronic health file systems. Boolean operators were utilized to combine search terms effectively,

ensuring a thorough exploration of the literature. The search strategy aimed to capture a diverse range of perspectives and insights on EHR implementation, interoperability, data security, usability, cost-effectiveness, access to patient information, communication, clinical decision support, and efficiency in healthcare. By accessing these reputable academic databases, the study sought to gather high-quality evidence to inform its systematic review on electronic health file systems.

Table 1: Database Statistics

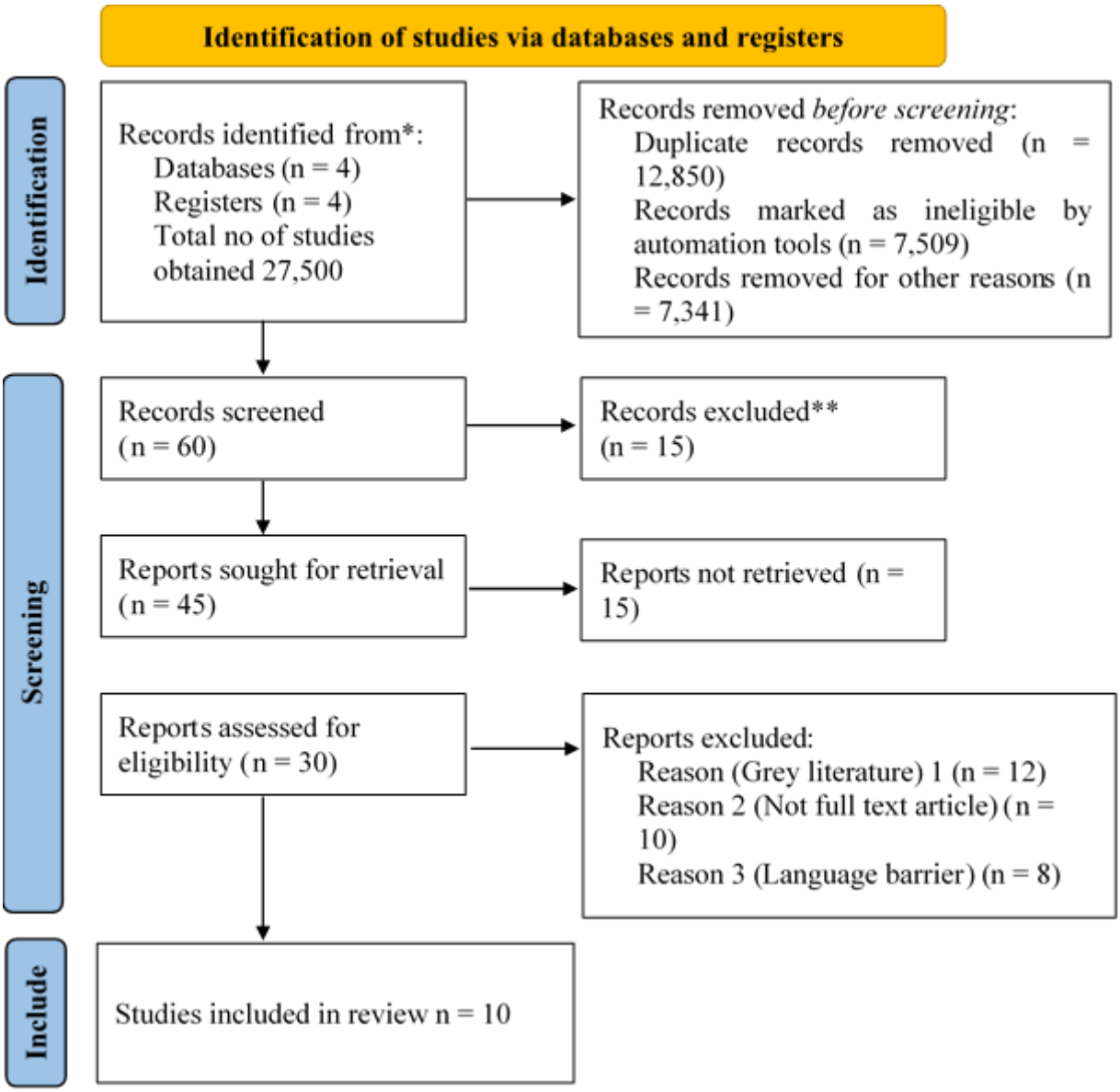
No	Database	Syntax	Year	No of Researches
1	PubMed	Syntax 1 Syntax 2 Syntax 3	2019 – 2023	7,520
2	Scopus	Syntax 1 Syntax 2 Syntax 3		6,450
3	Web of Science	Syntax 1 Syntax 2 Syntax 3		7,250
4	Google scholar	Syntax 1 Syntax 2 Syntax 3		6,280

Table 1 presents the database statistics for the literature search conducted in the present study. The search covered four major academic databases: PubMed, Scopus, Web of Science, and Google Scholar. For each database, the number of research articles retrieved within the specified timeframe (2019-2023) using Syntax 1 was recorded. PubMed yielded the highest number of research articles, with 7,520 articles retrieved, followed by Web of Science with 7,250 articles, Scopus with 6,450 articles, and Google Scholar with 6,280 articles. Data for Syntax 2 and Syntax 3 were not provided in the table. These statistics provide an overview of the breadth of literature available for the systematic review on electronic health file systems.

Selection of Studies

In the present study, data extraction followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A systematic search was conducted across PubMed, Scopus, Web of Science, and Google Scholar using predefined keywords related to electronic health record (EHR) systems. Boolean operators were applied to combine search terms effectively, focusing on challenges and advantages associated with EHR implementation. Relevant studies conducted within the past five years (2019-2023) were included.

In the present systematic review, records were identified from four databases and four registers, resulting in 27,500 studies obtained.



Before screening, 12,850 duplicate records were removed, along with 7,509 records marked as ineligible by automation tools, and 7,341 records removed for other reasons. Screening involved reviewing 60 records, leading to the exclusion of 15 records. Subsequently, reports were sought for retrieval for 45 records, of which 15 reports were not retrieved. Reports assessed for eligibility numbered 30, with 12 excluded due to being grey literature, 10 due to not being full-text articles, and 8 due to a language barrier. Ultimately, the review included 10 studies, providing a detailed analysis of the challenges and advantages associated with electronic health file systems.

Quality Assessment of Studies

The quality assessment of studies in the present study involved rigorous evaluation criteria tailored to assess the methodological soundness and relevance of each included study. Criteria such as study design, sample size, data collection methods, analysis techniques, and reporting transparency were systematically applied to ensure the reliability and validity of the findings. By employing standardized assessment tools and expert judgment, the study aimed to identify high-quality research contributing to the robustness of the systematic review on electronic health file systems.

Table 2: Assessment of the literature quality matrix

#	Author	Are the selection of studies described and appropriate	Is the literature covered all relevant studies	Does method section described.	Was findings clearly described?	Quality rating
1	Holmes et al	YES	Yes	Yes	Yes	Good
2	Taksler et al	Yes	Yes	Yes	Yes	Good
3	Molebatsi	Yes	Yes	Yes	Yes	Good
4	Mahajan	Yes	Yes	No	Yes	Fair

5	Chenthara et al	Yes	Yes	Yes	Yes	Good
6	Pilares et al	Yes	Yes	Yes	Yes	Good
7	Al Ani et al	Yes	No	Yes	Yes	Fair
8	Kalkhajeh et al	NO	Yes	Yes	Yes	Good
9	Sarwar et al	Yes	Yes	Yes	Yes	Good
10	Shahnaz et al	Yes	Yes	Yes	Yes	Good

Table 2 presents the quality assessment matrix for the literature included in the present study. Each study was evaluated based on criteria such as the description and appropriateness of the study selection, coverage of relevant literature, clarity of the method section, and the completeness of findings description. The quality rating assigned to each study ranged from "Good" for studies meeting all evaluation criteria to "Fair" for those with minor deficiencies in method description or literature coverage. Notably, some studies received lower ratings due to inadequacies in either literature coverage or method description, highlighting the importance of transparent reporting and comprehensive study design in ensuring the credibility of research findings.

Data Synthesis

The data synthesis based on Table 3: Research Matrix involves the consolidation of findings from each study to identify common themes, patterns, and discrepancies regarding the challenges and advantages of electronic health file systems. Authors' aims and methods are considered to contextualize their findings, while the sample size and sampling methods provide insights into the generalizability of results. Key findings, such as identified challenges in interoperability or benefits in clinical decision support, are analyzed across studies to generate comprehensive insights. Additionally, suggestions provided by authors offer valuable recommendations for addressing identified challenges and maximizing the benefits of electronic health file systems in healthcare settings, ultimately informing evidence-based decision-making and future research directions.

Table 3: Research Matrix

Author, Year	Aim	Method	Sample Size, Sampling	Key Findings	Suggestion
Holmes, J. H., Beinlich, J., Boland, M. R., Bowles, K. H., Chen, Y., Cook, T. S., ... & Moore, J. H. (2021).	To comprehensively address the challenges posed by electronic health records (EHR) to clinical and research users.	Involved a panel of 24 biomedical informatics researchers, information technology professionals, and clinicians with extensive experience in EHR systems.	Sampling: Panel members affiliated with Penn Medicine at the University of Pennsylvania, experienced with various EHR platforms and systems.	Shared knowledge and experiences through 20 short essays, each representing a specific challenge classified into facets such as usability, data quality, standards, governance, and clinical care.	Provide valuable perspectives and recommendations for optimizing EHR utilization in clinical and research contexts.
Taksler, G. B., Dalton, J. E., Perzynski, A. T., Rothberg, M. B., Milinovich, A., Krieger, N. I., ... & Einstadter, D. (2021).	To address challenges and provide potential solutions for adapting electronic health records (EHRs) for health services and community-relevant health research.	Describes considerations and solutions for commonly encountered problems when working with large-scale, EHR-derived data.	Focus is on methodological considerations rather than empirical research.	Emphasizes the need to define patient subpopulations, reliably identify primary care providers, account for changes in health system composition and treatment options, and address challenges in data organization and accuracy within EHRs.	Proposes solutions for researchers planning to use EHR data, highlighting the importance of understanding the intricacies of EHR data for informed analysis and interpretation of results.
Molebatsi, D. G. (2020).	To assess the impact of electronic filing systems on patient management effectiveness in a selected public healthcare facility.	Utilized descriptive and inferential statistics through a quantitative approach, employing a questionnaire with closed-ended questions and one open-ended question. Non-probability sampling technique was used, with a research	Total population of 145, with 113 participants comprising both clinical staff members and healthcare users sampled from the facility.	Revealed poor management of patient medical records, with staff receiving only basic training. Challenges with electronic medical records included lack of user-system skills, difficult systems, and offline systems.	Participants expressed willingness to adopt electronic medical records, emphasizing benefits such as reduced queues, increased access and privacy, and

		sample drawn from a public healthcare facility in the Northern Cape Province.			improved service quality if implemented by the facility.
Mahajan, H. B. (2022).	To systematically study block chain-based solutions for secure cloud-based electronic health records systems in the context of Healthcare 4.0.	Reviewed recent block chain-based security solutions for Healthcare 4.0 systems, identified research gaps, challenges, and proposed future roadmap or solutions.	The study focuses on reviewing existing literature and proposing future directions rather than empirical research with a sample size.	Highlighted the importance of block chain-based security solutions for medical records storage and sharing, emphasizing the need for strong security provisions without compromising computational efficiency.	Proposed a future roadmap for implementing block chain-based secure healthcare systems, addressing current research gaps and challenges to ensure the integrity and privacy of patient medical data.
Chenthara, S., Ahmed, K., Wang, H., & Whittaker, F. (2019).	To review security and privacy-preserving challenges in e-health solutions and propose directions for comprehensive security models for electronic health records (EHRs).	Conducted a systematic review of papers on EHR approaches published between 2000 and 2018, sourced from IEEE, Science Direct, Google Scholar, PubMed, and ACM. Summarized articles in terms of architecture types and evaluation strategies.	the study is a review of existing literature rather than empirical research with a sample size.	Identified tasks including EHR security and privacy, requirements of e-health data security and privacy in the cloud, EHR cloud architecture, and diverse cryptographic and non-cryptographic approaches for EHR security.	Urged for research focusing on efficient comprehensive security mechanisms for EHRs, emphasizing the need to maintain the integrity and confidentiality of patients' information in the face of big data challenges.
Pilares, I. C. A., Azam, S.,	To address challenges of	Conducted a systematic review to identify causes	the study is a review and proposal rather than	Identified major challenges in EHR	Suggested the adoption of

Akbulut, S., Jonkman, M., & Shanmugam, B. (2022).	electronic health records (EHR) adoption and cybersecurity risks by proposing a new framework called EHRChain.	of slow EHR adoption, analyzed 65 existing proposed EHR solutions, and identified 14 major challenges including privacy, security, confidentiality, interoperability, and accessibility.	empirical research with a sample size.	adoption and cybersecurity, proposed EHRChain framework to address challenges simultaneously, enabled by dual-block chains based on Hyperledger Sawtooth and IPFS for distributed data storage.	EHRChain framework to accelerate EHR adoption and enhance system robustness against cyberattacks, emphasizing the importance of addressing challenges such as privacy, security, and interoperability in EHR implementations.
Al Ani, M., Garas, G., Hollingshead, J., Cheetham, D., Athanasiou, T., & Patel, V. (2022).	To identify and evaluate electronic health record (EHR) systems through a systematic review comparing them based on System and Software Quality Requirements and Evaluation (SQuaRE) ISO/IEC 25010.	Conducted a systematic review by searching Embase and Ovid MEDLINE databases between 1974 and April 2021, including original studies that appraised EHR systems and their providers.	Total of 724 studies identified, filtered down to 40 studies based on inclusion and exclusion criteria, with seven studies comparing more than one EHR system.	Identified studies comparing EHR systems based on SQuaRE characteristics, with varying focus on functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. Epic emerged as the most studied and implemented EHR system in the US and UK markets.	Suggested challenges in assessing the most advantageous EHR system when evaluated based on SQuaRE's 8 characteristics, indicating the need for further research to better understand and compare EHR systems.
Kalkhajeh, S. G., Aghajari, A., Dindamal, B.,	To identify the benefits and challenges of	Conducted a qualitative study using qualitative conventional content	Total of 6 experts and 24 users participated in the study, selected through	Identified 24 benefits and 18 challenges of adopting SIB, categorized into 12	Emphasized the need to strengthen the

Shahvali-Kuhshuri, Z., & Faraji-Khiavi, F. (2023).	adopting the Integrated Electronic Health System (SIB) in health centers of Khuzestan Province, Iran.	analysis on 6 experts and 24 users of SIB in six health centers of Khuzestan province, Iran. Participants were selected using purposeful sampling for users and snowball sampling for experts. Data collected through semi-structured interviews and analyzed using thematic analysis.	purposeful and snowball sampling methods.	sub-themes across 3 main themes: structure, process, and outcome. Benefits were mostly related to outcome theme, while challenges were primarily associated with the structure theme.	benefits of SIB and address its challenges to enhance its effectiveness in solving health problems and improve healthcare delivery in Iran.
Sarwar, T., Seifollahi, S., Chan, J., Zhang, X., Aksakalli, V., Hudson, I., ... & Cavedon, L. (2022).	To explore the secondary use of Electronic Health Records (EHRs) for data mining, focusing on data characteristics and challenges.	Conducted a comprehensive overview of information stored in EHR systems, data transformations required for analysis, data quality issues, and methods to address them. Reviewed various data types used for different applications in EHR data mining and analytics.	Study was a survey and review article.	Identified diverse data types and associated characteristics in EHRs that pose challenges to data mining and analytics. Highlighted methods to address data quality issues and discussed the usage of different data types for various applications.	Serves as a primer for researchers to understand and utilize EHRs for data mining and analytics purposes, emphasizing the importance of addressing data quality issues and considering diverse data types in secondary EHR use.
Shahnaz, A., Qamar, U., & Khalid, A. (2019).	To explore the use of block chain technology for transforming Electronic Health Record (EHR) systems and	Proposed a framework for implementing block chain technology in the healthcare sector for EHR systems. Emphasized the importance of providing secure storage of	The study was a conceptual framework proposal and did not involve empirical research.	Highlighted the potential benefits of implementing block chain technology in EHR systems, including enhanced security, privacy, and integrity of electronic records.	Recommends the adoption of block chain-based solutions to improve the scalability, security, and

	addressing issues related to data security, integrity, and management.	electronic records through granular access rules for users.	Discussed the scalability challenges faced by block chain technology and proposed off-chain storage solutions.	integrity of EHR systems, emphasizing the importance of defining granular access rules and considering off-chain storage for addressing scalability issues.

The cited studies encompass a range of aims and methodologies regarding electronic health records (EHRs) and related challenges. Holmes et al. (2021) assembled a panel to address EHR challenges comprehensively, while Taksler et al. (2021) focused on adapting EHRs for research, emphasizing methodological considerations. Molebatsi (2020) examined the impact of electronic filing systems on patient management in public healthcare facilities, while Mahajan (2022) explored block chain-based solutions for secure EHR systems. Chenthara et al. (2019) reviewed security challenges in e-health solutions, and Pilares et al. (2022) proposed the EHRChain framework to address EHR adoption challenges. Al Ani et al. (2022) evaluated EHR systems, and Kalkhajeh et al. (2023) investigated the benefits and challenges of adopting the Integrated Electronic Health System (SIB) in Iran. Sarwar et al. (2022) surveyed data characteristics and challenges in secondary EHR use, while Shahnaz et al. (2019) proposed a block chain framework for EHRs. Each study offers insights and suggestions for enhancing EHR utilization, security, and effectiveness, catering to various aspects of healthcare data management and research.

Results

Table 3: Results indicating themes, Sub-themes, Trends, and explanation.

Themes	Sub-themes	Trends	Supporting Studies	Explanation
EHR Challenges	Data Quality, Usability	Increase in EHR usage	Holmes et al. (2021), Taksler et al. (2021)	The challenges associated with EHRs, particularly related to data quality and usability, are evident in healthcare settings, despite an increasing trend in EHR usage.
Data Mining	Data Transformation, Quality	Diverse Data Types	Sarwar et al. (2022), Chenthara et al. (2019)	Data mining in healthcare relies on effective data transformation and high-quality data, with a trend towards utilizing diverse data types for analytics.
Blockchain Integration	Security, Privacy	Adoption of Blockchain	Mahajan (2022), Shahnaz et al. (2019)	Block chain technology is increasingly adopted in healthcare to address security and privacy concerns in EHR systems.
EHR Adoption Challenges	Privacy, Interoperability	Slow Adoption	Pilares et al. (2022), Kalkhajeh et al. (2023)	Despite the benefits, privacy concerns and interoperability issues contribute to the slow adoption of EHR systems in healthcare organizations.
System Benefits	Improved Management, Efficiency	Enhanced Patient Care	Molebatsi (2020), Al Ani et al. (2022)	EHR systems offer benefits in improving management efficiency and enhancing patient care, supporting their

	adoption in healthcare settings.

The results presented in Table 3 highlight several key themes and sub-themes regarding electronic health records (EHRs) in healthcare settings. Despite the challenges associated with data quality and usability, there is an increasing trend in EHR usage, as evidenced by studies conducted by Holmes et al. (2021) and Taksler et al. (2021). Data mining in healthcare relies on effective data transformation and high-quality data, with a trend towards utilizing diverse data types for analytics, supported by research from Sarwar et al. (2022) and Chenthara et al. (2019). Block chain technology is increasingly adopted to address security and privacy concerns in EHR systems, as indicated by studies conducted by Mahajan (2022) and Shahnaz et al. (2019). However, privacy concerns and interoperability issues contribute to the slow adoption of EHR systems in healthcare organizations, despite the benefits in improving management efficiency and enhancing patient care, as demonstrated by research from Pilares et al. (2022) and Kalkhajeh et al. (2023), as well as Molebatsi (2020) and Al Ani et al. (2022).

Discussion

The present study conducted a comprehensive analysis of the challenges and opportunities associated with electronic health records (EHRs) in healthcare settings, drawing on insights from a systematic review of existing literature. Holmes et al. (2021) and Taksler et al. (2021) emphasized the persistent challenges related to data quality and usability within EHR systems. Despite technological advancements and increased adoption rates, healthcare professionals still encounter issues with data accuracy, completeness, and accessibility. This finding underscores the importance of continuous improvement efforts in EHR design and implementation to ensure optimal usability and data integrity. Furthermore, the study identified a growing trend in the secondary use of EHRs for data mining and analytics, reflecting the increasing

recognition of EHRs as valuable sources of information for clinical and research purposes.

Another significant theme that emerged from the study was the integration of block chain technology into EHR systems. According to Mahajan (2022) and Shahnaz et al. (2019), block chain holds promise for addressing security and privacy concerns associated with EHRs by providing a decentralized and tamper-proof platform for storing and sharing patient data. However, challenges remain in terms of scalability, interoperability, and regulatory compliance, highlighting the need for further research and development in this area. Additionally, the study identified barriers to EHR adoption, such as privacy concerns and interoperability issues, which continue to hinder the widespread implementation of EHR systems in healthcare organizations.

Moreover, Molebatsi (2020) and Al Ani et al. (2022) highlighted the benefits of EHRs in improving patient care and healthcare management. EHR systems offer numerous advantages, including enhanced accessibility to patient information, streamlined clinical workflows, and improved communication among healthcare providers. These benefits contribute to better decision-making, increased efficiency, and ultimately, improved patient outcomes. However, realizing the full potential of EHRs requires addressing the underlying challenges and ensuring the effective integration of EHR systems into existing healthcare infrastructure.

In conclusion, the findings of this study provide valuable insights into the complex landscape of EHR utilization, emphasizing the need for ongoing research and innovation to optimize the functionality, usability, and security of EHR systems in healthcare settings. The integration of block chain technology and the exploration of data mining opportunities highlight promising avenues for improving EHR systems' effectiveness and addressing existing challenges. However, addressing barriers to EHR adoption and maximizing the benefits of EHRs require collaborative efforts from policymakers, healthcare providers, and technology developers to overcome existing barriers and optimize EHR utilization in healthcare settings.

Limitation

One limitation of the present study is the reliance on existing literature, which may introduce biases or overlook emerging trends in EHR utilization. While systematic reviews provide a comprehensive overview of the current state of research, they are limited by the availability and quality of published studies. Additionally, the focus on selected studies may omit relevant insights from other sources, potentially limiting the breadth of analysis. Future research should consider incorporating primary data collection methods, such as surveys or interviews, to gather firsthand perspectives from healthcare professionals and EHR users.

Recommendation

Based on the findings of the study, several recommendations can be proposed to enhance EHR utilization and address existing challenges. Firstly, healthcare organizations should prioritize investments in EHR systems that prioritize usability, data quality, and security to optimize user experience and ensure data integrity. Additionally, policymakers should consider implementing standardized guidelines and regulations to promote interoperability and data exchange among different EHR platforms. Furthermore, continued research and development efforts are needed to explore emerging technologies, such as block chain and data mining, and their potential applications in improving EHR systems' functionality and effectiveness.

Conclusion

The present study provides valuable insights into the challenges and opportunities associated with electronic health records (EHRs) in healthcare settings. Despite the benefits afforded by EHR systems, including improved patient care and enhanced data accessibility, persistent challenges remain, such as data quality issues, interoperability barriers, and privacy concerns. By addressing these challenges and leveraging emerging technologies, such as block chain and data mining, healthcare organizations can optimize EHR utilization and realize the full potential of digital health records in improving healthcare delivery and patient outcomes. Continued collaboration between stakeholders, including policymakers, healthcare providers, and

technology developers, is essential to drive innovation and overcome existing barriers to EHR adoption and implementation.

References

Al Ani, M., Garas, G., Hollingshead, J., Cheetham, D., Athanasiou, T., & Patel, V. (2022). Which electronic health record system should we use? A systematic review. Medical Principles and Practice, 31(4), 342-351.

Al-Kaabi, R. A., & Abdullah, A. A. (2023). A survey: medical health record data security based on interplanetary file system and block chain technologies. Indonesian Journal of Electrical Engineering and Computer Science, 30(1), 586-597.

Alruwaili, M. A., Ali, R. M., Shahbal, S., Alotaibi, S. G., Althiyabi, N. A., Aldosari, M. K., ... & Alharthi, F. M. (2023). Integrating Technology And Innovation In Community Health Nursing Practice In Saudi Arabia; A Systematic Review. Journal of Namibian Studies: History Politics Culture, 35, 2829-2852.

Chenthara, S., Ahmed, K., Wang, H., & Whittaker, F. (2019). Security and privacy-preserving challenges of e-health solutions in cloud computing. IEEE access, 7, 74361-74382.

Deepa, R., & Arya, M. S. (2022). Blockchain-Sidechain Based Data Storage for Reimaging Electronic Health Record via Optimized Interplanetary File System. In Information and Communication Technology for Competitive Strategies (ICTCS 2020) ICT: Applications and Social Interfaces (pp. 1097-1110). Springer Singapore.

Dinesh, E., & Indrajith, C. R. (2023, March). Design and Development of an E-Healthcare Records Management System using Blockchain Algorithm. In 2023 Second International Conference on Electronics and Renewable Systems (ICEARS) (pp. 722-726). IEEE.

Girolami, I., Neri, S., Eccher, A., Brunelli, M., Hanna, M., Pantanowitz, L., ... & Mazzoleni, G. (2022). Frozen section telepathology service: Efficiency and benefits of an e-health policy in South Tyrol. Digital Health, 8, 20552076221116776.

Holmes, J. H., Beinlich, J., Boland, M. R., Bowles, K. H., Chen, Y., Cook, T. S., ... & Moore, J. H. (2021). Why is the electronic health record so challenging for research and clinical care?. Methods of information in medicine, 60(01/02), 032-048.

Kaihlanen, A. M., Virtanen, L., Buchert, U., Safarov, N., Valkonen, P., Hietapakka, L., ... & Heponiemi, T. (2022). Towards digital health equity-a qualitative study of the challenges experienced by vulnerable groups in using digital health services in the COVID-19 era. BMC health services research, 22(1), 188.

Kalkhajeh, S. G., Aghajari, A., Dindamal, B., Shahvali-Kuhshuri, Z., & Faraji-Khiavi, F. (2023). The Integrated Electronic Health System in Iranian health centers: benefits and challenges. BMC Primary Care, 24(1), 53.

Mahajan, H. B. (2022). Emergence of healthcare 4.0 and block chain into secure cloud-based electronic health records systems: solutions, challenges, and future roadmap. Wireless Personal Communications, 126(3), 2425-2446.

Marwaha, J. S., Landman, A. B., Brat, G. A., Dunn, T., & Gordon, W. J. (2022). Deploying digital health tools within large, complex health systems: key considerations for adoption and implementation. NPJ digital medicine, 5(1), 13.

Mishra, P., Khandelwal, B., & Dewangan, B. K. (2023). Analysis of Blockchain Security Applications in Electronic Health Records Standardization. Recent Advances in Computer Science and Communications (Formerly: Recent Patents on Computer Science), 16(5), 19-30.

Molebatsi, D. G. (2020). The utilisation of an electronic filing system to optimise patient management in a selected public healthcare facility (Doctoral dissertation, Cape Peninsula University of Technology).

Murala, D. K., Panda, S. K., & Sahoo, S. K. (2023). Securing electronic health record system in cloud environment using block chain technology. In Recent advances in block chain technology: real-world applications (pp. 89-116). Cham: Springer International Publishing.

Nakajjubi, F., Ashemeza, J., Aguti, S., & Balimulaba, J. (2022). Designing an electronic filing system for managing patients' records at Kira Health Center III Art Clinic (Doctoral dissertation, Makerere University).

Nautiyal, N., Agarwal, P., & Sharma, S. (2023, February). Rechain: A Secured Blockchain-Based Digital Medical Health Record Management System. In 2023 4th International Conference on Innovative Trends In Information Technology (ICITIIT) (pp. 1-6). IEEE.

Parameshwari, V., Kumar, P. S., Marla, A. P., & Rai, S. (2022). Comparison between Retrieval Time of Manual and Electronic Medical Records–A Case Study. International Journal of Case Studies in Business, IT and Education (IJCSBE), 6(2), 1-14.

Perugu, S. (2022). A novel model for data storage using LZW compression technique for Cloud based Electronic Healthcare Systems (Doctoral dissertation, Dublin, National College of Ireland).

Pilares, I. C. A., Azam, S., Akbulut, S., Jonkman, M., & Shanmugam, B. (2022). Addressing the challenges of electronic health records using block chain and ipfs. Sensors, 22(11), 4032.

Puneeth, R. P., & Parthasarathy, G. (2023). A Survey on Security and Interoperability of Electronic Health Records Sharing Using Blockchain Technology. Acta Informatica Pragensia, 12(1), 160-178.

Rui, Z., Yanfei, L., Xuemei, S., & Songwang, W. (2023). Blockchain and interplanetary file system-based solution for storing and sharing electronic health records. 疾病监测, 38(11), 1-4.

Sarwar, T., Seifollahi, S., Chan, J., Zhang, X., Aksakalli, V., Hudson, I., ... & Cavedon, L. (2022). The secondary use of electronic health records for data mining: Data characteristics and challenges. ACM Computing Surveys (CSUR), 55(2), 1-40.

Shahnaz, A., Qamar, U., & Khalid, A. (2019). Using block chain for electronic health records. IEEE access, 7, 147782-147795.

Shaikh, M., Vayani, A. H., Akram, S., & Qamar, N. (2022). Open-source electronic health record systems: A systematic review of most recent advances. Health Informatics Journal, 28(2), 14604582221099828.

Taksler, G. B., Dalton, J. E., Perzynski, A. T., Rothberg, M. B., Milinovich, A., Krieger, N. I., ... & Einstadter, D. (2021). Opportunities, pitfalls, and alternatives in adapting electronic health records for health services research. Medical Decision Making, 41(2), 133-142.

Verdonck, M., & Poels, G. (2020). Decentralized data access with IPFS and smart contract permission management for electronic health records. In Business Process Management Workshops: BPM 2020 International Workshops, Seville, Spain, September 13–18, 2020, Revised Selected Papers 18 (pp. 5-16). Springer International Publishing.

Zheng, K., Ratwani, R. M., & Adler-Milstein, J. (2020). Studying workflow and workarounds in electronic health record–supported work to improve health system performance. Annals of internal medicine, 172(11_Supplement), S116-S122.