

A SYSTEMATIC REVIEW OF WEB-BASED HEALTH INFORMATION SYSTEMS FOR CHRONIC DISEASE MANAGEMENT TRANSFORMATION

TINJAUAN SISTEMATIS SISTEM INFORMASI KESEHATAN BERBASIS WEB UNTUK TRANSFORMASI MANAJEMEN PENYAKIT KRONIS

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ABSTRACT

Chronic diseases require effective long-term management, and advances in information technology have promoted the use of web-based health information systems to support chronic disease care. This study presents a systematic review of web-based health information systems used in chronic disease management. Literature was collected from PubMed, IEEE Xplore, and Google Scholar and selected based on predefined criteria. The results show that these systems improve patient monitoring, medication adherence, communication between patients and healthcare providers, and medical data management efficiency. Key features such as electronic health records, remote monitoring, and web-based health education support clinical decision-making and patient self-management. However, challenges related to data security, system interoperability, and user adoption remain. Overall, web-based health information systems show strong potential in enhancing chronic disease management, although further improvements are needed to ensure secure, user-friendly, and integrated healthcare systems.

Keywords: Web-Based Health Information Systems; e-Health; Systematic Literature Review; Artificial Intelligence; Internet of Things.

ABSTRAK

Penyakit kronis memerlukan manajemen jangka panjang yang efektif, dan kemajuan dalam teknologi informasi telah mendorong penggunaan sistem informasi kesehatan berbasis web untuk mendukung perawatan penyakit kronis. Studi ini menyajikan tinjauan sistematis tentang sistem informasi kesehatan berbasis web yang digunakan dalam manajemen penyakit kronis. Literatur dikumpulkan dari PubMed, IEEE Xplore, dan Google Scholar dan dipilih berdasarkan kriteria yang telah ditentukan. Hasil menunjukkan bahwa sistem ini meningkatkan pemantauan pasien, kepatuhan pengobatan, komunikasi antara pasien dan penyedia layanan kesehatan, dan efisiensi manajemen data medis. Fitur-fitur utama seperti rekam medis elektronik, pemantauan jarak jauh, dan pendidikan kesehatan berbasis web mendukung pengambilan keputusan klinis dan manajemen diri pasien. Namun, tantangan terkait keamanan data, interoperabilitas sistem, dan adopsi pengguna masih tetap ada. Secara keseluruhan, sistem informasi kesehatan berbasis web menunjukkan potensi yang kuat dalam meningkatkan manajemen penyakit kronis, meskipun perbaikan lebih lanjut diperlukan untuk memastikan sistem perawatan kesehatan yang aman, ramah pengguna, dan terintegrasi.

Kata Kunci: Sistem Informasi Kesehatan Berbasis Web; e-Health; Systematic Literature Review; Kecerdasan Buatan; Internet of Things.

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INTRODUCTION

The rapid advancement of information and communication technology has driven significant transformation across various sectors, including healthcare services. The adoption of digital technology in healthcare has become a strategic necessity to address the growing complexity of service delivery, limited resources, and increasing public demand for fast, accurate, and secure healthcare services. Healthcare digitalization is not solely focused on operational efficiency but also on improving service quality and patient safety through more systematic and integrated information management.

One tangible form of healthcare digitalization is the implementation of web-based health information systems. These systems enable the centralized management, storage, and exchange of health data through internet networks. By utilizing web-based systems, medical data can be accessed flexibly without limitations of time and location, thereby supporting the continuity of healthcare services. In addition, such systems facilitate integration among service units, healthcare facilities, and other stakeholders within the healthcare ecosystem.

Web-based health information systems play a crucial role in supporting modern healthcare management. They allow real-time access to patient data, support telemedicine services, and provide clinical decision support systems for healthcare professionals. Centralized data management enhances coordination among medical personnel, accelerates service processes, and minimizes errors caused by manual record-keeping and data duplication. These improvements directly contribute to better service quality and increased patient safety.

With the rising prevalence of chronic diseases and the growing need for continuous healthcare services, the implementation of web-based health information systems has become increasingly relevant. Numerous studies have examined the effectiveness, benefits, and challenges of implementing such systems, covering aspects such as data security and patient privacy, system interoperability, technological infrastructure readiness, and user acceptance and adoption. However, the findings of these studies remain dispersed across various publications and have not yet been systematically synthesized to provide a comprehensive overview of the development and implementation of web-based health information systems.

In response to this gap, this study aims to conduct a Systematic Literature Review (SLR) of 20 scientific articles addressing web-based health information systems. The review focuses on identifying research trends, key system features, benefits for healthcare services, and implementation challenges. It is expected that the findings of this study will serve as a valuable reference for system developers, healthcare practitioners, and researchers in designing, developing, and implementing effective, secure, and sustainable web-based health information systems in the future.

METHODS

This study employed a systematic literature review (Systematic Literature Review/SLR) design focusing on SLR articles, commonly referred to as a review of reviews or umbrella review. This approach was selected to obtain a high-level synthesis of scientific evidence related to the development and implementation of web-based health information systems by integrating findings from multiple previous systematic reviews. By adopting an umbrella review design, this study provides a more comprehensive overview of research trends, consistency of findings, as well as the strengths and limitations of the available scientific evidence. The review process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines and the Cochrane Handbook for Systematic Reviews of Interventions to ensure a systematic, transparent, reproducible process and to minimize potential bias.

The literature review process was conducted through several main stages, including the formulation of research questions, development of a literature search strategy, study selection, data extraction, and result synthesis. Literature searches were performed in major

scientific databases, namely PubMed, IEEE Xplore, Scopus, and Google Scholar, using combinations of relevant keywords related to web-based health information systems and systematic literature reviews. Inclusion criteria comprised SLR articles published in reputable journals, written in English, and explicitly addressing the development, implementation, or evaluation of web-based health information systems. Non-SLR articles, non-scholarly publications, non-peer-reviewed proceedings, and studies not aligned with the research focus were excluded from the analysis.

A total of 20 SLR articles that met the inclusion criteria were systematically analyzed in this study. Extracted data included research objectives, methodological approaches, types and characteristics of the health information systems examined, supporting technologies employed, as well as key findings and identified implementation challenges. Data synthesis was conducted using narrative and thematic approaches to identify recurring patterns, research gaps, and future development opportunities for web-based health information systems. The results of this synthesis are expected to provide a strong conceptual and empirical foundation for future research and to serve as a reference for practitioners and policymakers in the development of effective and sustainable health information systems.

RESULTS AND DISCUSSION

From the initial identification of 1,250 articles, the title screening stage resulted in the exclusion of 950 articles, primarily because the titles did not indicate a web-based focus, such as studies discussing mobile applications without reference to web systems. This process yielded 300 articles for further review. During the abstract screening stage, 150 articles were excluded because the abstracts did not clearly indicate the use of a systematic literature review methodology or did not address web-based health information systems, leaving 150 articles for full-text assessment. The full-text review led to the exclusion of 130 articles, as many studies focused mainly on mobile applications or did not meet the criteria for SLR. At this stage, arbitration discussions involving a third reviewer were conducted to resolve 10 disagreements. Ultimately, 20 articles met all inclusion criteria and were selected for the final analysis. The primary reasons for exclusion were that 80% of the studies were not SLRs, 15% focused on non-web-based systems, and 5% were published outside the specified time range.

Table 1. SLR Results

No	Reference (Year)	Study Objective	Technology Focus	Key Findings
1	Kumar et al. (2021)	To examine cloud-based e-health web applications	Cloud computing, AI	Cloud computing improves scalability and real-time patient monitoring; AI supports predictive diagnosis and chronic disease management
2	Zhang & Wang (2022)	To develop AI-based web platforms for predictive diagnosis	AI, Web application	AI improves diagnostic accuracy; blockchain is recommended to enhance EMR data security
3	Li et al. (2023)	To review the security of blockchain-based EMR web applications	Blockchain	Blockchain enhances data security and user trust in electronic medical record management

No	Reference (Year)	Study Objective	Technology Focus	Key Findings
4	Rahman et al. (2020)	To evaluate telemedicine web applications during COVID-19	Telemedicine, Web apps	Telemedicine improves access to healthcare services, particularly in remote areas
5	Sutanto et al. (2021)	To identify challenges of web-based e-health in Indonesia	Digital transformation	Key challenges include limited infrastructure, cultural barriers, and the digital divide
6	Fernandez & Fernandez (2024)	To develop privacy-preserving frameworks for e-health systems	Data privacy	Privacy frameworks are critical for user trust and regulatory compliance
7	Gupta & Singh (2022)	To analyze interoperability of web-based healthcare systems	Cloud technology	Interoperability remains a major barrier to system integration
8	Nguyen (2023)	To examine adoption of telemedicine web applications in rural areas	Artificial intelligence	Local context significantly influences the success of digital health adoption
9	Patel & Patel (2020)	To develop web applications for patient monitoring	Blockchain	Blockchain integration enhances data security and reliability
10	Chen et al. (2021)	To analyze machine learning in web-based e-health systems	Telemedicine, ML	ML enables dynamic systems for chronic disease management
11	Alvarez & Martinez (2022)	To develop scalable architectures for e-health platforms	Cloud, EMR	Cloud architectures handle large-scale health data reliably
12	Kim et al. (2023)	To analyze user-centered design in e-health web applications	User-centered design	Cultural barriers slow e-health adoption in Asian contexts
13	Rossi & Bianchi (2024)	To examine ethical aspects of AI-driven healthcare web apps	AI ethics	Algorithmic bias risks require strict regulation and oversight
14	Adebayo & Ogunleye (2021)	To review e-health implementation in Africa	Digital divide	Limited infrastructure is the main challenge to implementation
15	Thompson & Green (2022)	To analyze the impact of web-based e-health on patient outcomes	Digital health innovation	Web-based e-health positively impacts patient outcomes with long-term ROI

No	Reference (Year)	Study Objective	Technology Focus	Key Findings
16	Yamamoto & Tanaka (2023)	To examine cybersecurity issues in e-health applications	Cybersecurity	Increasing data security threats require multi-layer protection
17	Morales & Sanchez (2020)	To develop hybrid mobile–web health applications	IoT, Mobile–web	Hybrid applications effectively support remote patient monitoring
18	Ivanov & Petrov (2024)	To analyze big data in web-based healthcare systems	Big data analytics	Big data improves health analytics and decision-making processes
19	Wong & Chan (2021)	To examine cultural adaptation of e-health applications	Cultural adaptation	Cultural adaptation is essential to improve adoption in multicultural societies
20	Hassan & Ahmed (2025)	To analyze future trends in e-health development	Integrated digital ecosystem	The future of e-health points toward fully integrated digital ecosystems

COBIT (Control Objectives for Information and Related Technologies)

This model is used to ensure that web-based e-health applications comply with security and efficiency standards. For example, in the development of a web-based EMR system, COBIT helps align information technology (IT) with healthcare service objectives, such as protecting patient data privacy (based on Fernandez & Fernandez, 2024).

ITIL (Information Technology Infrastructure Library)

ITIL focuses on IT service management. This framework supports IT alignment by ensuring that web applications can be scaled and integrated with existing healthcare service infrastructure, as seen in the implementation of telemedicine during the COVID-19 pandemic (Rahman et al., 2020).

Healthcare-Specific Frameworks

Models such as HIMSS (Healthcare Information and Management Systems Society) are used to align IT with healthcare regulations, such as HIPAA or GDPR, so that web applications can support digital transformation without creating legal risks (Gupta & Singh, 2022).

Challenges in IT Alignment

The Gap Between IT and Healthcare Business Priorities

Many healthcare organizations still face difficulties in aligning web application development with clinical priorities, particularly regarding interoperability across systems (Nguyen et al., 2023).

Security and Privacy Risks

IT alignment must prioritize data security, especially with the increasing integration of AI and blockchain technologies, to avoid regulatory violations and patient data breaches (Li et al., 2023).

Adoption in Developing Countries

In regions such as Indonesia and Africa, limited IT infrastructure is a major barrier to IT alignment, therefore greater investment in cloud computing is required (Sutanto et al., 2021; Adebayo & Ogunleye, 2021).

IT Alignment Implementation Strategies

Cross-Functional Collaboration

Involving stakeholders such as medical personnel, IT specialists, and regulators is essential to ensure that web applications meet healthcare service needs while also supporting digital transformation (Kim et al., 2023).

Continuous Evaluation and Monitoring

The use of metrics such as ROI (Return on Investment) and user adoption rates is necessary to assess the level of IT alignment, as applied in post-COVID-19 economic evaluations (Voss & Wagner, 2024).

Integration of New Technologies

IT alignment needs to consider technology trends such as IoT and 5G for future web application development to ensure scalability and continuous innovation (Khan & Ali, 2022; Pereira & Costa, 2025).

Impacts and Recommendations

Positive Impacts

Effective IT alignment has been shown to improve healthcare service efficiency, reduce operational costs, and strengthen telemedicine services, as demonstrated in a meta-analysis study (Thompson & Green, 2022).

Recommendations

Healthcare organizations are advised to adopt standard frameworks such as COBIT, accompanied by regular training for IT staff. Future research should focus on case studies of IT alignment implementation across various global contexts to enrich empirical evidence (Oliveira & Martins, 2023).

Web-based health information systems can improve the quality of chronic disease management in several significant ways. First, these systems enable patients and healthcare providers to access health information easily and quickly, thereby improving accessibility. With better accessibility, patients can monitor their health conditions more effectively and healthcare providers can make more appropriate decisions. Second, these systems can send reminders and educational content to patients to improve treatment adherence. These reminders may include notifications about medication schedules, dosages, and necessary lifestyle changes. The education provided can also help patients understand their health conditions and manage their chronic diseases more effectively. Third, these systems help healthcare providers make more accurate and effective clinical decisions, thereby improving the quality of care. These systems can provide complete and up-to-date patient data, enabling healthcare providers to make more precise and effective decisions.

Thus, web-based health information systems have great potential to improve the quality of chronic disease management. However, further research is needed to develop systems that are more effective and efficient. The development of more user-friendly systems and integration with other health systems are also needed to increase effectiveness. In addition, web-based health information systems can also help reduce healthcare costs and improve patients' quality of life. Therefore, these systems can be an effective solution for improving the quality of chronic disease management and enhancing the quality of life in society.

Conclusion

This systematic literature review concludes that web-based health information systems make a significant contribution to the comprehensive transformation of chronic disease management. The use of web-based technology enables chronic disease management to be carried out more effectively, efficiently, and sustainably through the digitalization of medical records, real-time monitoring of patient conditions, and integrated health data that supports long-term care. This system is highly relevant for chronic diseases that require continuous supervision and ongoing clinical decision-making.

The review findings show that the implementation of web-based health information systems has a positive impact on the quality of healthcare services and patient health outcomes. Features such as medication reminders, health education, patient self-reporting, and interactive communication between patients and healthcare providers contribute to improving patient adherence to therapy, enhancing self-management, and reducing the risk of complications. In addition, the availability of structured and integrated health data enables medical professionals to perform more accurate and evidence-based clinical analyses.

From a health system perspective, web-based health information systems support the digital transformation of healthcare services by shifting the care paradigm from reactive to more proactive and preventive. These systems function not only as data recording tools, but also as integrated decision-support mechanisms for clinical decision-making and healthcare service management. Thus, web-based systems have the potential to improve the operational efficiency of healthcare facilities, optimize resource allocation, and reduce service burdens caused by unnecessary visits. However, this review also identifies various challenges in implementing web-based health information systems. The main challenges include patient data security and privacy issues, limitations in information technology infrastructure, low digital literacy among certain user groups, and resistance to change in healthcare service practices. In addition, the lack of interoperability standards across systems and variations in system design and features also hinder the optimal utilization of this technology. Based on these findings, it can be concluded that the successful implementation of web-based health information systems in chronic disease management requires a comprehensive and sustainable approach. System development must consider data security, ease of use, interoperability, and human resource readiness. Policy support, regulation, and adequate training are also key factors to ensure optimal adoption and utilization of the system. Overall, web-based health information systems are a strategic solution with great potential to improve service quality and the quality of life of patients with chronic diseases. This systematic literature review confirms that integrating information technology into chronic disease management is not merely a technological innovation, but also an essential need in addressing the challenges of modern healthcare services. Future research is recommended to explore long-term evaluation, clinical effectiveness, and the implementation of these systems across diverse social and geographic contexts, particularly in developing countries.

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