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The Impact of Health Information Systems on Patient Outcomes

Donel Richemond¹, Taiwan Huggins-Jordan²

¹ Trinity Global College. Email: donelrichemond@gmail.com

² Valencia College. Email: sweatleisure@aol.com

Abstract

The Internet of Medical Things has actualized the digital transformation of the healthcare industry where information systems are leveraged by providers for enhanced performance and improved patient outcomes. In light of these systems' outsized role in healthcare management, it is essential to explore impacts on healthcare by discussing the advantages and disadvantages of Health Information Systems (HIMS). This study investigates the strengths and shortfalls of HIMS. It addresses the gap in scholarly literature that often focuses on isolated effects rather than providing a generalized understanding of HIMS advantages and liabilities. This research used the narrative review methodology that aggregates and synthesizes literature on the subject. The body of the text discusses advantages of health information systems such as enhancing systematic management of health data, reducing medical errors, promoting operational efficiency and decision making. The vulnerabilities of information systems discussed herein are implementation costs and privacy concerns. The terminal summarizes the paper's content, connecting it to impact on patient outcomes.

Keywords: Systematic Management, Medical Errors, Operational Efficiency, Decision-Making, Implementation Costs and Privacy

1. Introduction

Concepts such as patient-centeredness, value creation, best outcomes, evidence-based practice, and effective communication characterize modern healthcare (Kwame & Petrucka, 2021). Technology has enabled healthcare professionals to communicate effectively, resulting in improved patient care and the achievement of organizational goals. Providers utilizing health information technology can easily share information, monitor compliance, and gauge and enhance their performance (Alolayyan et al., 2020). However, like any other electronic data management system, this technology is plagued by privacy and security issues. However, studies in this field often focus on specific aspects, examining the strengths and limitations of healthcare information technology, while repositories lack diverse scholarly articles that comprehensively analyze the pros and cons of healthcare information systems. Therefore, this paper aims to comprehensively analyze this topic, with a specific focus on patient outcomes. By addressing this research gap, the paper aims to provide valuable insights into the advantages and limitations of healthcare information systems and their impact on patient care.

Automation is the proverbial indicator of the entrenchment of information technology which has transformed all life aspects, including healthcare. Information systems have revolutionized healthcare and transformed patient data management for improved care which reduces the frequency of adverse patient outcomes (Astier et al., 2020; Rudin et al., 2020). These systems have replaced inefficient physical records, ushering in an era of systematic data management that enables easy access to patients' information for a wide range of healthcare operations and research endeavors. Healthcare information tools like electronic health records, databases, and registries, have become invaluable tools offering various benefits such as enhanced operational efficiency, reduced medical errors, improved decision-making, and drive advancements in patient care (Wood et al., 2021). However, there are also challenges and potential drawbacks that need to be considered, as with any technology. Disadvantages of health information systems include implementation costs and privacy concerns. This research paper explores the advantages and downsides of healthcare information systems, delving into how these systems have transformed the healthcare landscape, ultimately enhancing the quality of patient care. Broadly, it is divided into advantages and disadvantages subsections, and a conclusion to capture the gist of the text.

2. Purpose Statement

This paper addresses an existing gap in scholarly literature regarding the comprehensive exploration of the advantages and disadvantages of health information systems (HIS). While numerous studies have focused on isolated effects of HIS, there is a lack of in-depth research that systematically examines the transformative impact of HIS on various aspects of healthcare delivery. This paper aims to contribute to the expanding knowledge body by synthesizing representative literature and perspectives on the advantages and disadvantages of HIS. Furthermore, the implications of these findings on patient outcomes will be inferred for valuable insights for healthcare practitioners, administrators, and policymakers.

3. Methodology

This study utilizes a qualitative research approach to integrate the effects of health information systems. The methodology was systematic collection and analysis of peer-reviewed articles for insights on these systems' advantages and disadvantages. Only articles published within the last three years were considered. Furthermore, articles had to undergo a rigorous peer-review process and be published in reputable journals. Electronic databases such as PubMed, and Google Scholar were searched using keywords related to health information systems and their effects. Initial searches yielded a large number of articles, which were screened based on titles and abstracts and the irrelevant ones were excluded. Importantly, this study focused on qualitative analysis of peer-reviewed articles without primary data collection or quantitative analysis.

4. Literature Review

In an article documenting the evolution of digital health, Cuff (2023) observes that technology has shifted healthcare focus from providers and become patient-centric. It involves stakeholders in diverse areas, such as healthcare, data technologies, and health informatics to improve diagnosis and disease management. Bulgarelli et al. (2020) highlight the potential of databases for secondary analysis of clinical data. By leveraging these repositories, healthcare providers can gain valuable insights into various facets of care for evidence-based practices and improved patient outcomes. Health digitization promotes epidemiological information for disease management. Jonker et al. (2022) suggest data information which assists healthcare providers to effectively manage diseases by identifying trends, tracking outcomes, and informing targeted interventions. Torab-Miandoab et al. (2023) emphasize that interoperability is crucial in maintaining care quality and preventing resource wastage, highlighting the essence of data standardization and seamless communication between healthcare entities. Health information systems can help mitigate errors by providing comprehensive patient records, decision support systems, and alerts, leading to enhanced patient safety and reduced medical errors. Rodziewicz et al. (2022) contend that errors of omission and commission, which can compromise patient safety, can be mitigated through cross-professional collaboration and communication to improve outcomes for all patients.

Küing et al. (2021) conducted a study on the effects of barcode technology on medication preparation and administration systems. Their findings suggest that health information systems utilizing barcode technology can improve medication safety, reduce errors, and streamline workflows, ultimately enhancing patient care. Seixas et al. (2021) emphasize how electronic systems generate data that can inform administrators on resource allocation and help optimize employee performance. Health information systems enable data-driven decision-making, facilitating efficient resource allocation and improving overall healthcare service delivery. Health information systems utilize algorithms and automated clinical knowledge bases to provide evidence-based recommendations to healthcare providers. Winter et al. (2023) highlight how such systems aid in clinical decision-making, resulting in improved patient outcomes. For instance, these systems have been shown to decrease the number of hypoglycemic events, promoting safer and more effective patient care (Kouri et al., 2022).

Research by Bulgarelli et al. (2020) estimates that implementing systems such as electronic health record (EHR) systems is a significant financial burden; in addition to the initial implementation costs, organizations need to manage the necessary back-office technology, including servers, data backup, storage, and other infrastructure (Elharish, 2021). Keshta and Odeh (2020) and Basil et al. (2022) discuss the challenges associated with inappropriate data releases from healthcare organizations and systemic information flows across healthcare-related industries. The HIPAA Journal's Healthcare Data Breach Report highlights the pervasive nature of privacy concerns in the healthcare sector, with a significant number of reported data breaches attributed to external hacking incidents (HIPAA Journal, 2023).

5. Literature Gap

The literature gap in this research area lies in the limited availability of scholarly-grade literature that comprehensively explores the advantages and disadvantages of health information systems. While the transformative impact of these systems has been extensively researched, the existing literature predominantly focuses on isolated aspects or specific effects, resulting in fragmented knowledge. Moreover, a significant portion of the available literature comprises popular sources such as health blogs or informal publications, which may lack rigorous academic analysis and evidence. This gap highlights the need for an integrative review that critically examines the overall benefits and challenges associated with health information systems. By conducting a comprehensive analysis of the existing literature, this research aims to fill the gap by providing a scholarly-grade text that systematically evaluates the advantages and disadvantages of these systems.

6. Discussion

6.1 *Advantages of Information Management Systems*

6.1.1 Better health data management

The healthcare industry generates and utilizes a vast amount of data with the aim of improving services. Patient records, diagnostic test results, and biomedical research contribute to this data. However, without systematic management, the meaningful utilization of this data becomes unattainable. Sophisticated informatics solutions play a crucial role in the intricate steps of data processing. Centralized storage and retrieval of patient information exemplify the importance of data organization in databases and repositories, ultimately enhancing data accessibility and retrieval. According to Bulgarelli et al. (2020), databases hold great potential for secondary analysis of clinical data, providing insights into various care facets. Patient registries, which collect data about patients with common characteristics such as a specific diagnosis, have emerged as essential data sources for healthcare practices, drug utilization, and clinical outcomes. These registries provide epidemiological information that assists healthcare providers in managing diseases (Jonker et al., 2022). To enable information exchange and optimize health outcomes, interoperability is essential. Interoperability pertains to the sharing of health data between organizations, guided by standards for use. Different information systems and devices must be able to access, exchange, integrate, and cooperatively utilize data within and across organizations. Interoperability ensures information portability and facilitates data access in the required formats. Torab-Miandoab et al. (2023) highlight the negative impact of a lack of interoperability, which diminishes care quality and leads to resource wastage. As the healthcare industry continues to evolve and face new challenges,

interoperability will play a critical role in mediating output and input systems, enabling efficient data access and fostering improved patient care.

6.1.2 Reduced Medical Errors

Reducing medical errors and improving patient safety are critical objectives in healthcare. Medical errors can have serious consequences for patient well-being and can result from various factors, including communication issues and inconsistent procedures. Implementing health information tools such as electronic medical records (EMRs) and barcoding systems has shown promise in decreasing hospital medication errors. Rodziewicz et al. (2022) highlight errors of omission and commission as two types of medical errors that can compromise patient safety. Errors of omission involve crucial actions not being taken, while errors of commission occur when incorrect actions are taken. These errors can range from failing to provide necessary assistance to a patient to administering the wrong medication or mislabeling laboratory specimens. To address these issues, health information tools are employed to improve medication safety. Kung et al. (2021) conducted a study on the effects of barcode technology on medication preparation and administration systems. The researchers found a significant decrease in the overall rate of medication preparation errors when barcode technology was implemented. The risk reduction associated with this decline in medication errors was approximately 54.5%. Barcode technology improves medication safety by enhancing traceability in the supply chain and reducing the likelihood of medication errors during preparation and administration. In the context of the COVID-19 pandemic, Lachman and van der Wilden-van Lier (2021) discuss the utility of barcoding systems. They emphasize that barcoding promotes product integrity and reliability, particularly in the case of vaccines.

6.1.3 Operational Efficiency

Hospital Information Management Systems are crucial in enhancing healthcare organizations operational efficiency. These software solutions automate administrative and clinical processes, improving patient outcomes and streamlining operations. One area where HIMS significantly improves efficiency is patient registration and appointment scheduling. By electronically capturing patient information, HIMS reduce errors and enhance data accuracy. This streamlined process simplifies patient registration and enables efficient appointment scheduling, resulting in optimal resource utilization and minimized wait times for patients. Paling et al. (2020) highlight the negative impact of long waiting times in emergency departments on patient outcomes, including higher mortality rates. Efficient appointment scheduling facilitated by HIMS can help mitigate these adverse effects. In a study by Pitter et al. (2022) on OnkoNetwork, a Hungarian cancer patient management network, the implementation of HIMS resulted in a 70% reduction in average waiting times for patients. This improvement was achieved by leveraging the system's capabilities to better issue patient call-ups, thereby optimizing patient flow and reducing delays. HIMS enable data-driven decision-making and allow administrators to allocate resources based on department needs, the specialty of healthcare professionals, and their experience. This ensures that resources are allocated effectively and caregivers' skills are fully utilized. Furthermore, HIMS provide data monitoring and analysis capabilities that allow managers to track performance metrics, optimize employee scheduling, and inform strategic decision-making. Seixas et al. (2021) emphasize how electronic systems generate data that can inform administrators on resource allocation and help optimize employee performance. By monitoring data, managers can prioritize scheduling to meet patients' needs, adjust staffing levels based on demand, and ensure that caregivers are assigned tasks that align with their expertise.

6.1.4 Better Decision-Making

Health information systems facilitate improved decision-making in healthcare through various mechanisms, including clinical decision support systems (CDSS). These systems utilize algorithms and automated clinical knowledge bases to provide evidence-based recommendations to healthcare providers, aiding in clinical decision-making (Winter et al., 2023). CDSS encompass a range of functions, such as diagnostics, disease management, alarm systems, and prescription support. They can take the form of computerized alerts, order sets, data reports, clinical workflow tools, and documentation templates. One of the primary benefits of CDSS is their ability to enhance patient safety by reducing medication errors. Computerized provider order entry (CPOE) systems with drug safety software help healthcare providers enter and send treatment instructions while

incorporating safeguards to prevent medication errors. Alerts generated by CDSS are among the most commonly used decision support tools. These alerts can remind healthcare providers of important medical events and guide them in adhering to best practices. For example, CDSS can be used to monitor and manage blood glucose levels, automatically prompting nurses to measure glucose according to specific protocols based on patient demographics and historical trends. This approach has been shown to decrease the number of hypoglycemic events (Kouri et al., 2022). CDSS can also support follow-up care by alerting healthcare providers when patients are due for follow-up appointments or when they deviate from management plans. This proactive reminder system helps ensure that patients receive timely and appropriate care.

6.2. Disadvantages of Health Information Systems

6.2.1 Initial implementation costs

The initial implementation costs of health information systems, particularly electronic health records (EHR), can be a significant barrier to adoption for healthcare organizations. Research conducted by Bulgarelli et al. (2020) provides estimates on the costs associated with implementing EHR systems in multi-physician practices. The study suggests that these practices can expect to spend around \$162,000 for EHR implementation, with a major portion of the expenses allocated to maintenance costs in the first year. When it comes to implementation, there are two primary deployment options to consider: on-premise and cloud-based. With on-premise deployment, the EHR solution is hosted on the organization's own servers. This may involve purchasing a perpetual license, which typically requires a significant upfront fee. Additionally, organizations need to manage the necessary back-office technology, such as servers, data backup, storage, and other infrastructure (Elharish, 2021). On the other hand, cloud-based deployment involves storing data on the vendor's servers, accessible through the internet. This model typically involves a subscription-based pricing structure, settled either monthly or annually. While cloud-based EHR systems may incur upfront costs in addition to the subscription, they often offer more flexibility and scalability for healthcare organizations. In addition to the direct implementation costs, it is essential to consider indirect costs associated with healthcare information system implementation. These hidden expenses can make up a significant portion of the overall implementation cost. For instance, budgeting for proper EHR training for healthcare providers is crucial. While training may seem costly, inadequate training can lead to productivity losses and potential errors in patient care (Elharish, 2021). Vendors often highlight the initial productivity dip as employees become accustomed to the new software. Healthcare organizations need to carefully assess their budget and plan for both the direct and indirect costs of implementing health information systems. Proper financial planning, considering factors such as deployment options, maintenance costs, training, and productivity impact, will help ensure a successful and sustainable implementation process.

6.2.2 Privacy issues

Privacy concerns are a significant issue when it comes to healthcare information systems. There are two general categories of privacy concerns: inappropriate data releases from healthcare organizations and systemic information flows across healthcare-related industries (Keshta & Odeh, 2020; Basil et al., 2022). Inappropriate data releases can occur when authorized users intentionally or unintentionally access or distribute information contrary to organizational policies. It can also happen when outsiders breach a system. Systemic concerns relate to the disclosure of patient data to malicious parties who may act against a patient's interests. Healthcare information systems involve the flow of data across various systems within an organization, as well as to secondary users such as payers. This makes health data stored by individual organizations vulnerable to security breaches and confidentiality violations. Internal agents, including valid users, may overstep their boundaries by accessing information for unauthorized purposes, such as viewing records of friends or sharing information publicly. External agents, without authorized access, attempt to access and manipulate data or disrupt the system. Healthcare organizations typically have experience countering internal threats but may have limited experience in protecting health information from external attacks. The HIPAA Journal's Healthcare Data Breach Report for the previous year highlights the pervasive nature of privacy concerns in the healthcare sector. In 2022, there were 707 reported data breaches, making it the second-worst year in history for reported breaches. The preceding year, 2021, reached a historical high with 715 breaches. The majority of these breaches were attributed to external hacking incidents (HIPAA Journal, 2023). Such data breaches put patients and healthcare providers at

risk of fraud and identity theft, but the most significant concern is the potential threat to patient safety. Cyber-attacks can lead to system outages that can last for several weeks, severely disrupting patient care. Although fatalities from these incidents are rare, compromised patient data can impact patient outcomes through delays in diagnosis and treatment.

7. Limitations

1. Bias in Source Selection: The research is susceptible to bias due to the inclusion and exclusion of sources. It is conceivable that the researcher purposely or inadvertently favored studies aligning with their preconceived notions, resulting in unbalanced conclusions.
2. Lack of Primary Data: Employing a literature review as the research methodology meant there was no primary data collection. Unlike other research methodologies, literature reviews rely on existing studies and secondary data sources, which can limit the researcher's analytical approaches.
3. Incomplete or Biased Information: Additionally, the study may not have covered all relevant sources due to the likely omission of important studies or alternative perspectives, potentially leading to an incomplete understanding of the topic.

8. Conclusion

In conclusion, the advent of information systems has revolutionized the healthcare industry by streamlining data management and improving patient care. These systems have replaced laborious and inefficient physical records, enabling easy access to patient information for various healthcare operations and research purposes. Databases and registries serve as valuable resources for researchers, providing insights into disease management and promoting better patient outcomes. Healthcare information systems have also significantly reduced medical errors, which can have detrimental effects on patient outcomes. Tools like electronic medical records and barcodes ensure precision and accuracy in healthcare processes, minimizing the risk of errors in prescription and diagnosis. Operational efficiency is enhanced through the automation of processes in healthcare information systems. Automated scheduling systems reduce patient wait times and optimize resource utilization. Addressing long wait times positively impacts patient outcomes, as highlighted by research findings. Improved decision-making is another advantage of health information systems. Clinical decision support systems provide healthcare providers with suggestions and recommendations based on patient demographics and historical trends. This assists in administering treatments and implementing care routines, ultimately leading to more informed and effective decision-making. However, it is important to acknowledge the disadvantages of information systems. Prohibitive implementation costs pose a challenge for some healthcare organizations, requiring careful budget planning and resource allocation. Privacy and security issues are also significant concerns, as healthcare information systems can be vulnerable to data breaches and unauthorized access. Mitigating these risks requires robust security measures and ongoing monitoring.

References

- Basil, N. N., Ambe, S., Ekhaton, C., & Fonkem, E. (2022). Health Records Database and Inherent Security Concerns: A Review of the Literature. *Cureus*, 14(10). <https://doi.org/10.7759/cureus.30168>
- Bulgarelli, L., Núñez-Reiz, A., & Rodrigo Octavio Deliberato. (2020). *Building Electronic Health Record Databases for Research*. https://doi.org/10.1007/978-3-030-47994-7_4
- Cuff, A. (2023). The evolution of digital health and its continuing challenges. *BMC Digital Health*, 1(1). <https://doi.org/10.1186/s44247-022-00004-x>
- F. Elharish, S., Denna, I., M. Maatuk, A., & K. Elberkawi, E. (2021). Application of Electronic Health Records in Polyclinics: Barriers & Benefits. *International Conference on Data Science, E-Learning and Information Systems 2021*. <https://doi.org/10.1145/3460620.3460628>
- HIPAA Journal, H. (2023, January 24). *2022 Healthcare Data Breach Report*. HIPAA Journal. <https://www.hipaajournal.com/2022-healthcare-data-breach-report/>
- Jonker, C. J., Bakker, E., Kurz, X., & Plueschke, K. (2022). Contribution of patient registries to regulatory decision making on rare diseases medicinal products in Europe. *Frontiers in Pharmacology*, 13. <https://doi.org/10.3389/fphar.2022.924648>

- Keshta, I., & Odeh, A. (2020). Security and privacy of electronic health records: Concerns and challenges. *Egyptian Informatics Journal*, 22(2), 177–183. <https://doi.org/10.1016/j.eij.2020.07.003>
- Kouri, A., Yamada, J., Lam Shin Cheung, J., Van de Velde, S., & Gupta, S. (2022). Do providers use computerized clinical decision support systems? A systematic review and meta-regression of clinical decision support uptake. *Implementation Science*, 17(1). <https://doi.org/10.1186/s13012-022-01199-3>
- Küng, K., Aeschbacher, K., Rüttsche, A., Goette, J., Zürcher, S., Schmidli, J., & Schwendimann, R. (2021). Effect of barcode technology on medication preparation safety: a quasi-experimental study. *International Journal for Quality in Health Care*, 33(1). <https://doi.org/10.1093/intqhc/mzab043>
- Lachman, P., & van der Wilden-van Lier, E. (2021). Use of Barcode Technology Can Make a Difference to Patient Safety in the Post COVID era. *IJQHC Communications*, 1(1). <https://doi.org/10.1093/ijcoms/lyab014>
- Paling, S., Lambert, J., Clouting, J., González-Esquerré, J., & Auterson, T. (2020). Waiting times in emergency departments: exploring the factors associated with longer patient waits for emergency care in England using routinely collected daily data. *Emergency Medicine Journal*, 37(12), emermed-2019-208849. <https://doi.org/10.1136/emered-2019-208849>
- Pitter, J., Moizis, M., Ezer, É. S., Lukács, G., Szigeti, A., Repa, I., Csanádi, M., Rutten-van Mölken, M. P. M. H., Islam, K., Kaló, Z., & Vokó, Z. (2022). Improved survival of non-small cell lung cancer patients after introducing patient navigation: A retrospective cohort study with propensity score weighted historic control. *E0276719*. <https://doi.org/10.1371/journal.pone.0276719>
- Rodziewicz, T. L., Houseman, B., & Hipskind, J. E. (2022). *Medical Error Reduction and Prevention*. PubMed; StatPearls Publishing. <https://www.ncbi.nlm.nih.gov/books/NBK499956/#:~:text=Identify%20patient%20safety%20dangers%20and>
- Seh, A. H., Zarour, M., Alenezi, M., Sarkar, A. K., Agrawal, A., Kumar, R., & Khan, R. A. (2020). Healthcare Data Breaches: Insights and Implications. *Healthcare*, 8(2), 133. NCBI. <https://doi.org/10.3390/healthcare8020133>
- Seixas, B. V., Regier, D. A., Bryan, S., & Mitton, C. (2021). Describing practices of priority setting and resource allocation in publicly funded health care systems of high-income countries. *BMC Health Services Research*, 21(1). <https://doi.org/10.1186/s12913-021-06078-z>
- Torab-Miandoab, A., Samad-Soltani, T., Jodati, A., & Rezaei-Hachesu, P. (2023). Interoperability of heterogeneous health information systems: a systematic literature review. *BMC Medical Informatics and Decision Making*, 23(1). <https://doi.org/10.1186/s12911-023-02115-5>
- Whicher, D., Ahmed, M., Siddiqi, S., Adams, I., Zirkle, M., Grossmann, C., Carman, K., & Washington. (2021). *HEALTH DATA SHARING TO SUPPORT BETTER OUTCOMES BUILDING A FOUNDATION OF STAKEHOLDER TRUST NATIONAL ACADEMY of MEDICINE*. https://nam.edu/wp-content/uploads/2021/07/Health-Data-Sharing-to-Support-Better-Outcomes_508.pdf
- Winter, A., Elske Ammenwerth, Haux, R., Marschollek, M., Steiner, B., & Jahn, F. (2023). *Quality of Health Information Systems*. 189–209. https://doi.org/10.1007/978-3-031-12310-8_5