The Impact of Health Information Systems on Patient Outcomes

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Abstract

The Internet of Medical Things (IoMT) has driven the digital transformation of the healthcare industry, where information systems are leveraged by providers for enhanced performance and improved patient outcomes. Given these systems' outsized role in healthcare management, it is essential to explore their impacts on healthcare by discussing the advantages and disadvantages of health information systems (HIS). This study investigates the strengths and shortcomings of HIS. It addresses the gap in scholarly literature, which often focuses on isolated effects rather than providing a general understanding of the advantages and disadvantages of HIS. This research employed the narrative review methodology, which aggregates and synthesizes literature on the subject. The main body of the text discusses the benefits of HIS, such as improving the systematic management of health data, reducing medical errors, and promoting operational efficiency and decision-making. The vulnerabilities of information systems discussed here are implementation costs and privacy concerns. The conclusion summarizes the paper's content and connects it to its impact on patient outcomes.

Subject Areas

Sociology

Keywords

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

1. Introduction

Concepts such as patient-centeredness, value creation, best outcomes, evidence-

based practice, and effective communication characterize modern healthcare (Kwame & Petrucka, 2021) [1]. Technology has enabled healthcare professionals to communicate effectively, resulting in improved patient care and the achievement of organizational goals. Providers using health information technology can easily share information, monitor compliance, and measure and enhance their performance (Alolayyan *et al.*, 2020) [2]. However, like any other electronic data management system, this technology is fraught with privacy and security issues. 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 advantages and disadvantages of health information systems (HIS). Therefore, this paper aims to analyze this topic comprehensively, focusing on patient outcomes. By addressing this research gap, the paper aims to provide valuable insights into the advantages and limitations of HIS and their impact on patient care.

Automation is the proverbial indicator of the entrenchment of information technology, which has transformed all aspects of life, including healthcare. Information systems have revolutionized health care and transformed patient data management for improved care, reducing the frequency of adverse patient outcomes (Astier *et al.*, 2020 [3]; Rudin *et al.*, 2020 [4]). These systems have replaced inefficient physical records and ushered in an era of systematic data management, enabling easy access to patient information for a wide range of health care operations and research. Health care information tools such as electronic health records, databases, and registries have become invaluable tools that provide several benefits, including increased operational efficiency, reduced medical errors, improved decision-making, and advances in patient care (Wood *et al.*, 2021) [5]. However, as with any technology, challenges and potential drawbacks must be considered. The disadvantages of HIS include implementation costs and privacy concerns. This research paper addresses the advantages and shortcomings of HIS and explores how these systems have transformed the health care landscape and ultimately enhanced the quality of patient care. This paper is roughly divided into subsections on the advantages and disadvantages and a conclusion to capture the essence of the text.

2. Purpose Statement

This paper addresses an existing gap in the scholarly literature regarding comprehensive research on the advantages and disadvantages of HIS. While numerous studies have focused on the isolated effects of HIS, there is a lack of in-depth research that systematically examines its transformative impact on various aspects of health care delivery. This paper aims to contribute to the growing body of knowledge by synthesizing the representative literature and perspectives on the benefits and drawbacks of HIS. In addition, the implications of these findings for patient outcomes are derived as valuable insights for health care practitioners, administrators, and policymakers.

3. Methodology

This study used a qualitative research approach to integrate the impact of HIS. The methodology consisted of a systematic collection and analysis of peer-reviewed articles to gain insight into the advantages and disadvantages of these systems. Only articles published within the last three years were considered. In addition, the articles had to have undergone a rigorous peer-review process and been published in reputable journals. Electronic databases such as Pub Med and Google Scholar were searched using keywords related to HIS and its impact. The initial searches yielded many articles that were screened based on titles and abstracts, and irrelevant ones were excluded. Importantly, this study focused on the 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) [6] observed that technology has shifted the focus of health care from providers to patients. It involves stakeholders from diverse areas, such as health care, data technologies, and health informatics, to improve diagnosis and disease management. Bulgarelli *et al*. (2020) [7] highlighted the potential of databases for secondary analysis of clinical data. By leveraging these repositories, health care providers can gain valuable insights into different facets of care to drive evidence-based practices and improved patient outcomes. The digitization of health care is advancing epidemiological information for disease management. Jonker *et al*. (2022) [8] proposed data information that assists health care providers in-effectively managing diseases by identifying trends, tracking outcomes, and informing targeted interventions. Torab-Miandoab *et al*. (2023) [9] emphasized that interoperability is crucial in maintaining quality of care and avoiding resource waste, under scoring the importance of data standardization and seamless communication among health care facilities. HISscan help prevent errors by providing comprehensive patient records, decision support systems, and alerts, increasing patient safety and reducing medical errors. Rodziewicz *et al*. (2022) [10] contended that errors of omission and commission, which can compromise patient safety, can be mitigated through cross-professional collaboration and communication to improve patient outcomes.

Küng *et al*. (2021) [11] conducted a study on the impact of barcode technology on medication preparation and administration systems. Their findings suggest that HISs that use barcode technology can improve medication safety, reduce errors, and streamline workflows, ultimately enhancing patient care. Seixas *et al*. (2021) [12] emphasized how electronic systems can generate data, inform administrators about resource allocation, and optimize employee performance. HIS enables data-driven decision-making that facilitates efficient resource allocation and improves overall health care service delivery. HIS uses algorithms and automated clinical knowledge bases to provide evidence-based recommenda-

tions to health care providers. Winter *et al.* (2023) [13] addressed how such systems support clinical decision-making, leading to improved patient outcomes. For example, these systems have been shown to reduce hypoglycemic events and promote safer and more effective patient care (Kouri *et al.*, 2022) [14].

Research by Bulgarelli *et al.* (2020) [7] estimated that implementing systems such as electronic health records (EHRs) represents a significant financial burden. In addition to the initial implementation costs, organizations must manage the necessary back-office technology, including servers, data backup, storage, and other infrastructure (Elharish, 2021) [15]. Keshta and Odeh (2020) [16] and Basil *et al.* (2022) [17] discussed the challenges associated with inappropriate data sharing by health care organizations and systemic information flows across health care industries. *The HIPAA Journal's* "Healthcare Data Breach Report" stressed the pervasiveness of privacy concerns in the health care sector, with a significant number of reported data breaches attributed to external hacking incidents (Alder, 2023) [18].

5. Literature Gap

The literature gap in this research area lies in the limited availability of scientifically sound literature that comprehensively examines the advantages and disadvantages of HIS. While there has been extensive research on the transformative impact of these systems, the existing literature predominantly focuses on isolated aspects or specific effects, resulting in fragmented knowledge. In addition, a significant portion of the available literature comprises popular sources such as health blogs or informal publications that may lack rigorous academic analysis and evidence. This gap under scores the need for an integrative review that critically examines the overall benefits and challenges associated with HIS. Through a comprehensive analysis of the existing literature, this research aims to address this gap by providing a scholarly 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 health care industry generates and uses a vast amount of data with the goal of improving its services. Patient records, diagnostic test results, and biomedical research all contribute to this data. However, without systematic management, the meaningful use of this data is 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 organizing data into databases and repositories to improve data accessibility and retrieval. According to Bulgarelli *et al.* (2020) [7], databases have great potential for secondary analysis of clinical data and provide insight into various aspects of care. Patient registries, which collect data on patients with common characteristics,

such as a specific diagnosis, have been shown to beessential data sources for healthcare practices, medication use, and clinical outcomes. These registries provide epidemiologic information that helps health care providers manage diseases (Jonker *et al.*, 2022) [8].

Furthermore, interoperability is critical to enabling information exchange and optimizing health outcomes. Interoperability refers to sharing health data between organizations that adhere to standards. Different information systems and devices must be able to access, exchange, integrate, and use data cooperatively within and across organizations. Interoperability ensures information portability and facilitates data access in the required formats. Torab-Miandoab *et al.* (2023) [9] pointed out the negative impact of a lack of interoperability, which diminishes the quality of care and leads to wasted resources. As the health care industry continues to evolve and face new challenges, interoperability will play a significant role in mediating output and input systems, enabling efficient data access, and promoting better patient care.

6.1.2. Reduced Medical Errors

Reducing medical errors and improving patient safety are critical objectives in health care. Medical errors can seriously affect patient well-being and result from various factors, including communication problems and inconsistent procedures. The implementation of health information tools such as electronic medical records (EMRs) and barcoding systems has shown promise in decreasing hospital medication errors. Rodziewicz *et al.* (2022) [10] identified errors of omission and errors of commission as two types of medical errors that can compromise patient safety. Errors of omission occur when important actions are not taken, whereas errors of commission occur when incorrect actions are taken. These errors can range from failing to assist a patient to administering the wrong medication or mislabeling laboratory specimens. Health information tools are employed to improve medication safety in order to address these issues. In Küng *et al.*'s (2021) [11] study on the effects of barcode technology, 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 decrease in medication errors was approximately 54.5%. Barcode technology improves medication safety by enhancing supply chain traceability 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) [19] discussed the utility of barcoding systems and suggested that barcoding promotes product integrity and reliability, particularly in the case of vaccines.

6.1.3. Operational Efficiency

Hospital information management systems (HIMS) are critical to enhancing the operational efficiency of health care organizations. 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 capturing patient information electronically, HIMS reduces errors and enhances data accuracy. This streamlined process simplifies patient registration and enables efficient appointment scheduling, optimizing resource utilization and minimizing patient wait times. Paling *et al.* (2020) [20] pointed out 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) [21] on Onko-Network, a Hungarian cancer patient management network, the implementation of HIMS resulted in a 70% reduction in average patient wait times. This improvement was achieved by leveraging the system's capabilities to better issue patient calls to optimize patient flow and reduce delays.

HIMS enables data-driven decision-making that allows administrators to allocate resources based on departmental needs, health care professionals' specialties, and experiences; white list, ensuring resources are allocated effectively, and caregivers' skills are fully utilized. In addition, HIMS provides data monitoring and analysis capabilities that allow managers to track performance metrics, optimize employee scheduling, and inform strategic decision-making. Seixas *et al.* (2021) [12] showed how electronic systems generate data that can inform administrators about resource allocation and help optimize employee performance. By monitoring data, managers can prioritize scheduling to meet patient 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

HIS facilitates improved healthcare decision-making through various mechanisms, including clinical decision support systems (CDSS). These systems use algorithms and automated clinical knowledge bases to provide evidence-based recommendations to health care providers to support clinical decision-making (Winter *et al.*, 2023) [13]. CDSS encompasses a range of functions, including 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 its ability to enhance patient safety by reducing medication errors. Computerized provider order entry (CPOE) systems with drug safety software help health care providers enter and send treatment instructions while providing safeguards to prevent medication errors. Alerts generated by CDSS are among the most commonly used decision-support tools. These alerts can remind health care providers of important medical events and guide them toward 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 reduce hypoglycemic events (Kouri *et al.*, 2022) [14]. CDSS

can also support follow-up care by notifying health care 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 EHRs, can be a significant barrier to adoption for health care organizations. Research conducted by Bulgarelli *et al.* (2020) [7] provided estimates of the costs associated with implementing EHR systems in multi-physician practices. The study suggested that these practices can expect to spend about $162,000 on EHR implementation, with a large portion of the expense related to first-year maintenance costs. Regarding implementation, there are two primary options to consider: on-premises and cloud-based. With on-premises deployment, the EHR solution is hosted on the organization's own servers, resulting in a process that may involve purchasing a perpetual license, which typically requires a significant upfront payment fee. Additionally, organizations need to manage the necessary back-office technology, such as servers, data backup, storage, and other infrastructure (Elharish, 2021) [15].

On the other hand, cloud-based provisioning stores data on the vendor's servers that are accessible through the Internet. This model typically involves a subscription-based pricing structure billed monthly or annually. While cloud-based EHR systems may incur upfront costs in addition to subscription costs, they often offer more flexibility and scalability for health care organizations. In addition to direct implementation costs, it is also essential to consider the indirect costs associated with implementing HIS. These hidden expenses can make up a significant portion of the overall implementation costs. For instance, budgeting for proper EHR training for health care providers is crucial. Training may seem costly, but inadequate training can lead to lost productivity and potential errors in patient care (Elharish, 2021) [15]. Vendors often emphasize the initial drop in productivity as employees become accustomed to the new software. Health care organizations must carefully assess their budgets and plan for both the direct and indirect costs of implementing health information systems. Proper financial planning that considers factors such as deployment options, maintenance costs, training, and the impact on productivity will help ensure a successful and sustainable implementation process.

6.2.2. Privacy Issues

Privacy concerns are a significant issue regarding health care information systems. There are two general categories of privacy concerns: inappropriate data releases by health care organizations and systemic information flows across health care-related industries (Basil *et al.*, 2022 [17]; Keshta & Odeh, 2020 [16]). Inappropriate data releases can occur when authorized users intentionally or

unintentionally access or distribute information contrary to organizational policies. This can also happen when outsiders breach a system. Systemic concerns relate to the disclosure of patient data to malicious parties who may act against the patient's best interests. HIS involves the flow of data between different systems within an organization as well as to secondary users such as payers, making health data stored by individual organizations vulnerable to breaches of security and confidentiality. Internal agents, including authorized users, may overstep their boundaries by accessing information for unauthorized purposes, such as viewing friends' records or sharing information publicly. External agents without authorized access may attempt to access and manipulate data or disrupt the system.

Health care organizations typically have experience defending against internal threats but may have limited experience protecting health information from external attacks. *The HIPAA Journal's* breach report mentioned above for the past year under scores the ubiquity of privacy concerns in the health care sector. In 2022, there were 707 reported data breaches, making it the second-worst year on record for reported breaches. The previous year, 2021, reached an all-time high with 715 breaches. Most of these breaches were attributed to external hacking incidents (Alder, 2023) [18]. Such data breaches put patients and health care providers at risk of fraud and identity theft. Still, the biggest concern is the potential threat to patient safety. Cyberattacks can lead to system outages that can last several weeks and severely disrupt patient care. Although fatalities from these incidents are rare, compromised patient data can affect patient outcomes by delaying diagnosis and treatment.

7. Limitations

1) Bias in source selection: This research is susceptible to bias because of the inclusion and exclusion of sources. It is conceivable that the researcher may have intentionally or inadvertently favored studies that aligned with their preconceived notions, resulting in unbalanced conclusions.

2) Lack of primary data: The use of a literature review as the research methodology meant that primary data were not collected. Unlike other research methodologies, literature reviews rely on existing studies and secondary data sources, which can limit the researcher's analytical approach.

3) Incomplete or biased information: In addition, the study may not have included all relevant sources, omitting important studies or alternative perspectives, which may lead to an incomplete understanding of the topic.

8. Conclusion

In conclusion, the introduction of HIS has revolutionized the health care industry by streamlining data management and improving patient care. These systems have replaced tedious and inefficient physical records, enabling easy access to patient information for various health care operations and research purposes.

Databases and registries serve as valuable resources for researchers, providing insights into disease management and promoting better patient outcomes. HIS has also significantly reduced medical errors, which can adversely affect patient outcomes. Tools such as EMSs and barcoding ensure precision and accuracy in health care processes and minimize the risk of errors in prescribing and diagnosis. Operational efficiency is enhanced by automating processes in HIS. Automated scheduling systems reduce patient wait times and optimize resource utilization. As research shows, addressing long wait times positively impacts patient outcomes. Another benefit of HIS is improved decision-making. CDSS provides health care providers with suggestions and recommendations based on patient demographics and historical trends. Together, these benefits and suggestions help in the administration of treatments and the implementation of care routines, ultimately leading to more informed and effective decision-making. However, it is vital to recognize the drawbacks of HIS. Prohibitive implementation costs pose a challenge for some health care organizations and require careful budget planning and resource allocation. Privacy and security issues are also major concerns, as HIS can be vulnerable to data breaches and unauthorized access. Mitigating these risks requires robust security measures and ongoing monitoring.

Conflicts of Interest

The authors declare no conflicts of interest.

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