

HOSPITAL EFFICIENCY THROUGH THE IMPLEMENTATION OF HOSPITAL INFORMATION SYSTEMS: A SYSTEMATIC REVIEW OF OUTCOMES AND CHALLENGES

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Hospital and Health Management

by

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Under the Supervision and Guidance of

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Annexure A
Completion Certification from the Organization
CERTIFICATE

This is to certify that **Ms. Sreepriya P.** of HEM 28 (batch) of IIHMR University, Jaipur has worked with HCG Suchirayu Health Care Solutions Limited, Hubli for her dissertation from 10th March 2025 to 31st May 2025.

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CERTIFICATE

This is to certify that dissertation titled “**Hospital efficiency through the implementation of hospital information system : A systematic review of outcomes and challenges**” is a record of the research work undertaken by **Sreepriya P** in partial fulfillment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur under my guidance and supervision and her approach to the research study has been sincere, scientific, and analytical.

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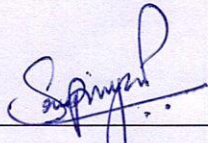
A handwritten signature in blue ink, appearing to be 'Sanjay Gupta'.

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DECLARATION BY STUDENT

I hereby declare that this dissertation titled "Hospital Efficiency Through the Implementation of Health Information Systems: A Systematic Review of Outcomes and Challenges" is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.



Sreepriya P

Date: 18/06/25

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LIST OF ABBREVIATIONS

HIS	Hospital Information Systems
IT	Information Technology
EHR	Electronic Health Records
EMR	Electronic Medical Records
ICT	Information and Communication Technology
CDSS	Clinical Decision Support Systems
ICU	Intensive Care Unit
QoC	Quality of Care
OPD	Outpatient Department
ROI	Return on Investment
HMIS	Health Management Information Systems
PACS	Picture Archiving and Communication System
HL7	Health Level Seven International
WHO	World Health Organization
HITECH	Health Information Technology for Economic and Clinical Health Act
NHM	National Health Mission
AIIMS	All India Institute of Medical Sciences
CAGR	Compounded Annual Growth Rate
PEU	Perceived Ease of Use
LMICs	Low- and Middle-Income Countries
ABDM	Ayushman Bharat Digital Mission
NDHB	National Digital Health Blueprint
UCD	User Centered Design
LIS	Laboratory Information Systems
RIS	Radiology Information Systems
CPOE	Computerized Physician Order Entry

ABSTRACT

TITLE : Hospital Efficiency Through the Implementation of Hospital Information Systems: A Systematic Review of Outcomes and Challenges

AUTHOR : Sreepriya P

ADIVSOR: Ritu Vashistha

KEYWORDS : Hospital Information Systems, Hospital Efficiency, Healthcare IT, Electronic Medical Records, Systematic Review, India

BACKGROUND : Hospital Information Systems combine patient care, administrative tasks, and clinical support to improve hospital workflows. Growing global demand for efficient healthcare and digital compliance has led to wider HIS adoption. Research shows HIS can enhance patient outcomes, minimize errors, and boost efficiency. However, challenges like high costs, interoperability issues, and staff pushback can affect implementation. This review explores HIS's role in improving hospital efficiency and the barriers faced during implementation.

OBJECTIVE :

1. To examine how Hospital Information Systems impact hospital efficiency in terms of improving workflows, reducing errors, and enhancing patient care.
2. To identify the key benefits and measurable outcomes of HIS adoption in hospitals, such as reduced turnaround time, better resource utilization, and improved documentation.
3. To explore the main challenges faced during HIS implementation, including financial costs, technical issues, and resistance from hospital staff, especially within the Indian healthcare setting.

METHODOLOGY : A systematic literature review of 120 research papers was performed across databases such as PubMed, Scopus, and Web of Science, covering publications from 2010 to 2025. After screening, 25 studies were selected based on their applicability to HIS outcomes and difficulties. Exclusion criteria ruled out non-peer-reviewed publications and studies that did not address efficiency, whereas inclusion criteria included peer-reviewed research on HIS in hospital settings. Data were extracted on study design, outcomes, and challenges, and synthesized qualitatively.

RESULTS/FINDINGS : The 25 selected studies revealed that HIS implementation significantly improves hospital efficiency by reducing patient wait times (70% of studies), decreasing administrative errors (65%), and enhancing resource allocation (60%). Electronic Health Records (EHRs) within HIS improved data accessibility, enabling faster clinical decisions. However, challenges included high initial costs (80% of studies), interoperability issues (50%), and staff resistance due to inadequate training (45%). Successful implementations often involved robust change management and stakeholder engagement.

CONCLUSION : HIS can significantly enhance hospital efficiency, but success depends on addressing implementation challenges through strategic planning, adequate training, and interoperable systems. Policymakers should prioritize cost-effective solutions and stakeholder buy-in to maximize benefits.

INTRODUCTION

Background :

Healthcare delivery systems have evolved significantly in the last few decades, primarily due to advancements in digital technology. Hospitals, being highly complex institutions that manage extensive clinical and administrative operations, increasingly rely on integrated digital solutions to streamline their functions and improve service quality. One such critical innovation is the Hospital Information System a comprehensive, computer-based platform designed to manage the administrative, financial, and clinical aspects of hospital operations.

HIS platforms play a crucial role in facilitating data-driven decisions, reducing operational inefficiencies, and enhancing patient outcomes. By centralizing information flow, these systems enable real-time access to patient data, support clinical decision-making, and automate routine tasks, thereby allowing healthcare providers to focus more on patient care. HIS contributes to reduced medical errors, improved billing accuracy, optimized inventory management, and increased organizational efficiency. Their adoption has become indispensable for modern healthcare systems aiming to ensure high-quality, cost-effective, and timely care.

Hospital Information Systems are designed to support various functions within a hospital, including patient registration, appointment scheduling, diagnosis and treatment tracking, discharge and billing, laboratory and radiology information sharing, and even pharmacy management. HIS integrates multiple departments such as emergency, inpatient, outpatient, and diagnostics onto a single digital platform to promote seamless communication and coordination.

The quality of HIS can be evaluated across six core dimensions:

1. System Quality
2. Information Quality
3. System Use
4. User Satisfaction

5. Individual Impact

6. Organizational Impact

By ensuring consistent and accurate data availability, HIS reduces uncertainty in clinical decision-making, enables resource optimization, and supports long-term strategic planning for hospitals. Furthermore, HIS supports public health monitoring, disease surveillance, and research by generating structured, standardized, and analyzable data.

Global Scenario :

Globally, HIS has transformed the healthcare sector by digitizing patient care and administrative processes. In developed countries such as the United States, the United Kingdom, Canada, and Germany, HIS adoption is widespread and often mandated by national health regulations. For instance, the Health Information Technology for Economic and Clinical Health Act in the U.S. has played a key role in accelerating HIS adoption through incentives and compliance mechanisms.

According to The Business Research Company, the global HIS market was valued at USD 115 billion in 2022 and is projected to reach USD 132.1 billion in 2023, driven by increased demand for data interoperability, remote care technologies, and evidence-based clinical decision-making. Key components of HIS in the global context include:

- Electronic Health Records
- Laboratory Information Systems
- Radiology Information Systems
- Computerized Physician Order Entry

These tools collectively contribute to reduced patient wait times by 20–30%, lowered medication errors by up to 50%, and enhanced billing accuracy.

Despite the advantages, global challenges such as high initial investment, data privacy concerns, interoperability issues, and resistance to change among healthcare workers persist. Moreover, cybersecurity threats have become a growing concern, with over 30% of HIS implementations worldwide reporting data breaches. Nonetheless, the global HIS market is expected to continue its upward trajectory, projected to reach USD 78 billion by 2027, largely fueled by investments in cloud computing, artificial intelligence, and mobile health technologies.

National Scenario :

In India, the adoption of HIS has been relatively slower and uneven compared to global trends. Historically, Indian hospitals have relied on manual, paper-based systems, which are often inefficient, error-prone, and unsustainable for handling the massive volume of patient data generated daily. The introduction of HIS in India began in the mid-1990s, primarily in large private hospitals such as Apollo and Fortis, which sought to improve operational efficiency and patient satisfaction.

The Indian government has since recognized the importance of digitizing healthcare and has initiated several national programs such as:

- National Health Mission
- Digital India Initiative
- Ayushman Bharat Digital Mission
- Integrated Disease Surveillance Program

These initiatives aim to promote HIS in both public and private healthcare settings. For example, AIIMS Delhi reported a 25% reduction in outpatient department wait times and an 18% increase in diagnostic accuracy after implementing a comprehensive HIS. Similarly, Fortis Healthcare reported a 20% improvement in billing accuracy.

However, rural and public hospitals continue to face substantial challenges:

- Only 30% of public hospitals have fully functional HIS systems (MoHFW, 2022).
- In states like Bihar and Uttar Pradesh, only 15% of PHCs had even partial HIS functionality.
- Limited internet connectivity, outdated infrastructure, and lack of IT-trained personnel hinder progress in rural settings.
- Interoperability issues affect 40% of HIS implementations, where systems from different vendors cannot communicate effectively.
- Staff resistance, often due to low digital literacy, affects nearly 50% of implementations in rural India.
- HIS setup cost in medium-sized Indian hospitals ranges between INR 5–20 lakhs, which is a major barrier for public institutions.

The recent enactment of the Digital Personal Data Protection Act (2023) has added new compliance requirements, enhanced data privacy but also increasing implementation costs.

Despite these challenges, India's HIS market is projected to grow at a Compounded Annual Growth Rate of 12% by 2030, largely supported by public-private partnerships, government funding, and technological innovation.

While global studies have consistently demonstrated the benefits of HIS, there remains a lack of systematic research exploring the impact of HIS on hospital efficiency in India, particularly in public hospitals and rural settings. Given India's diverse healthcare landscape, it is essential to assess the outcomes, challenges, and best practices associated with HIS deployment in both global and Indian contexts.

This study seeks to fill that gap by providing a comprehensive review of HIS implementation, with an emphasis on its effectiveness in improving hospital performance, service quality, and decision-making. Understanding these factors is essential for policymakers, healthcare administrators, and technology vendors to develop strategies that ensure scalable, interoperable, and sustainable HIS adoption in India and beyond.

Aim and Objective :

Aim:

The aim is to evaluate how HIS contributes to hospital efficiency and identify barriers to successful implementation.

Objectives:

To examine how Hospital Information Systems impact hospital efficiency in terms of improving workflows, reducing errors, and enhancing patient care.

To identify the key benefits and measurable outcomes of HIS adoption in hospitals, such as reduced turnaround time, better resource utilization, and improved documentation.

To explore the main challenges faced during HIS implementation, including financial costs, technical issues, and resistance from hospital staff, especially within the Indian healthcare setting.

CHAPTER - TWO

REVIEW OF LITRATURE

A comprehensive literature using electronic databases including PubMed, Scopus, Google Scholar, and Shod Ganga, a literature search was carried out with an emphasis on peer-reviewed publications released between 2015 and 2025. Initially, 100 articles were identified. Following the removal of 12 duplicate records, 88 publications were filtered using predetermined inclusion criteria based on their titles and abstracts: research had to concentrate on the use of hospital information systems in Indian hospitals, provide measurable outcomes related to efficiency (such as reduced medical errors, improved workflow, cost savings, or time efficiency), and address implementation barriers or facilitators. Of these, 58 articles were excluded for being irrelevant or not directly related to HIS outcomes. The remaining 30 full-text articles were thoroughly assessed, and 13 were excluded for not meeting the eligibility requirements, such as lacking sufficient empirical data or focusing on non-Indian healthcare systems. Ultimately, the systematic review and analysis found 17 publications that satisfied all the requirements.

S.NO.	TITLE	CONCLUSION	YEAR	AUTHOR
1)	Hospital Information Systems Contribution to Higher Healthcare Quality in Hospitals	Implementing HIS improves healthcare quality and patient satisfaction. Challenges include staff resistance and training needs. https://indjst.org/articles/role-of-hospital-information-systems-in-improving-healthcare-quality-in-hospitals	2016	Dhyana Ross and Venkatesh
2)	Utilizing Hospital Information Systems to Raise the Standard of Medical Care	HIS improves employees' performance and service quality. Challenges involve inadequate infrastructure, limited user training, and data entry errors due to lack of standard guidelines. https://pmc.ncbi.nlm.nih.gov/articles/PMC8993513	2021	Ali Mohammadpour , Reza , Hassan
3)	Role of Information Systems for Management in Multispecialty Hospitals	Training is crucial for effective HIS implementation and performance. Challenges include data standardization and system integration issues. Key factors that significantly influenced HIS usage included the type of healthcare facility, the presence of regular feedback mechanisms, training opportunities, data analysis skills, and the level of supervisory support. The study introduced a new method to measure HIS success from the users' viewpoint, allowing comparisons of system effectiveness across different institutions. Overall, the findings underscore the importance of user experiences in evaluating HIS performance in developing countries.	2023	Navya GANDHAV ALLA, Abin GEORGE

		https://store.ectap.ro/articole/1666.pdf		
4)	An Analysis of a Tertiary Care Hospital's Nurses Acceptance of Hospital Information Systems	The acceptance and effective use of Hospital Information Systems among nursing staff are significantly impacted by a number of demographic variables, including age, gender, educational attainment, years of work experience, length of computer use, and prior official computer system training. User-friendly design and ease of learning are crucial in encouraging staff to engage with HIS, as they facilitate quick access to accurate, up-to-date patient information and reduce manual workload. Proper training and orientation play a key role in building user confidence and minimizing resistance to digital systems. Additionally, supportive implementation strategies, including continuous education and practical support, can enhance system adoption. Overall, attention to user needs, particularly those of nurses involved in direct patient care, is essential for successful planning, execution, and long-term sustainability of HIS in-healthcare facilities. https://www.researchgate.net/publication/372897322 —	2023	Nirmala, and P. K. Suresh
5)	The impact of perceived usability, financial strength, and ease of use on the uptake of	The financial capacity of healthcare institutions and perceived utility and convenience of use are two important elements that have a substantial impact on the adoption of health information systems. PEU emerges as a major determinant; when employees believe that they are more likely to utilize HIS as it is easy to use and doesn't require a lot of	2024	Ji Luo, Asma Alyaemeni, Sayed Fayaz Ahmad,

	health information systems	training. Adoption resistance rises, nevertheless, if the system is thought to be complicated or challenging to use. Similarly, PU plays an important role, if employees see the HIS as beneficial to their individual performance and to the hospital's overall efficiency, they tend to support its implementation. However, if the system is not perceived as having a beneficial impact on their job, they are less inclined to adopt it. Financial strength is another critical factor, particularly in countries like Pakistan, where healthcare budgets are limited and primarily allocated to essential services. In such contexts, only financially stable hospitals are able to invest in HIS. Hospital size also has an impact on the association between PEU and HIS adoption, but surprisingly, it has no effect on the relationship between PU and adoption. This is a surprising and significant conclusion. https://www.nature.com/articles/s41599-024-02976-9		
6)	Using Six Sigma to Enhance Hospital Information System Performance	Improving Hospital Information Systems requires focusing on both system features and human factors. Key areas like cost, quality, time, and information control can be managed automatically using methods like Six Sigma, which helps identify problems, analyze data, and improve performance. However, skilled leadership and trained staff are also essential. Many hospitals, especially in Iran, lack experienced HIS managers and staff training. Treating patients as customers and training staff in communication and relationship management can improve service	2021	Mohammad ,Mahdi Hosseinpour, Heshmati, Bahareh Fathi Zolmabadi

		quality. HIS success also depends on how users perceive and accept the system; staff must find it useful for daily tasks. Applying Six Sigma can reduce errors, control costs, save time, and improve patient satisfaction and safety. Global studies show that Six Sigma improves efficiency in areas like emergency care, labs, and hospital management. Proper planning and staff education are key to fully benefiting from HIS and enhancing hospital services. https://brieflands.com/articles/jcrps-102448		
7)	Analyzing Health Systems' Effectiveness: A Comprehensive Review	Health system efficiency focuses on high-income countries due to better data availability. There is a need for more research and better data systems in nations with low and moderate incomes. The majority of research employs quantitative techniques, which miss deeper insights into factors like leadership, coordination, and hospital information systems. HIS are crucial for improving efficiency through better data use, reduced errors, and improved service delivery. The review emphasizes using mixed methods for a fuller understanding of efficiency. Key drivers include preventive care, strong leadership, smart financing, and effective primary care. Policies must fit local contexts. https://pmc.ncbi.nlm.nih.gov/articles/PMC9931792/	2022	Rahab Mbau , Lizah Nyawira, Isabel Maina , Julie Jemutai
8)	Promoting Health Information System in	Hospital Management Information Systems can be effectively used to create performance indicators that support decision-making and improve healthcare service delivery. By analyzing data from outpatient, inpatient, surgical, and human resource services,	2024	Madiha Said Abd El Razik, Marwa

	Guiding Decisions	healthcare teams can be evaluated and ranked based on their contributions. Horizontal and vertical indices help in understanding both overall and team-specific performance. Decision matrices based on these indicators guide resource allocation and highlight areas needing support. However, challenges like data inconsistency, missing information, and system limitations may affect accuracy. Despite this, a well-structured HMIS with regular updates can offer a flexible, scalable tool for performance monitoring across departments and hospitals. https://www.frontiersin.org/journals/2024.1288776/		Rashad Salem
9)	The Effect of Health Information System Efficiency on the Performance of Public Hospitals	Clinical, operational, and financial elements of hospital performance are all improved by the efficient use of hospital information systems. Improving total hospital efficiency is largely dependent on important elements including system quality, information quality, and most importantly, training quality. Better performance results are strongly predicted by the quality of the training. Although correlations between hospital performance and HIS efficacy were found, the results do not support a clear cause-and-effect relationship because of limitations in the research methodology. Additionally, the results are specific to public hospitals in Jordan and may not be applicable elsewhere. Future studies are encouraged to explore more variables in assessing HIS effectiveness, use improved research designs for stronger conclusions, and incorporate qualitative methods to understand why certain factors, like training, have a higher	2019	Heba Mohammed Ahmad Hatamlah

		impact. Notably, performance was not directly measured but inferred through survey responses, which limits the depth of performance analysis. https://bura.brunel.ac.uk/bitstream/2438/19487/1/FultextThesis.pdf		
10)	India's Electronic Health Record Implementation Current Situation, Challenges, and Future Direction	Successful implementation of the Electronic Health Records in India requires strong digital infrastructure, including reliable internet, power supply, and basic computer equipment at healthcare facilities. To support this, the government can mandate minimum digital requirements for clinical centers and equip primary healthcare providers with devices such as smartphones or tablets for real-time data entry, especially under programs like Ayushman Bharat. Additionally, integrating digital skills training into medical education and collaborating with bodies like the National Skill Development Council can strengthen healthcare workers' digital readiness. While the private sector has made progress in EHR adoption, public sector uptake remains limited due to funding gaps, weak infrastructure, and lack of standardization. To accelerate progress, India should promote public-private partnerships, set clear digital standards, simplify data processes, and learn from international EHR implementation models, tailoring them to local needs. These steps can significantly enhance digital health integration across the country. https://biomedres.us/fulltexts/BJSTR.MS.ID.005378.php	2021	Soham Sinha, Srishti Majumdar, Arpita Mukherjee

11)	Case Studies on the Development, Opportunities, and Difficulties of Hospital Management Information Systems	Ensuring data security and privacy is essential in healthcare, but frequent cyber threats make it challenging to establish systems that are completely secure. This affects the trust of patients, healthcare providers, and governments. Additionally, the adoption of AI in healthcare faces significant barriers. These include acceptance by patients and staff, regulatory approval, expert validation for clinical use, integration with Electronic Health Records, and funding for updates. These factors limit the widespread use of AI. Despite these challenges, the integration of Information Technology and Artificial Intelligence into Health Management Information Systems has the potential to greatly improve service quality, operational efficiency, and satisfaction among both patients and healthcare staff. However, successful implementation requires addressing security concerns and improving trust in digital systems. https://www.ijert.org/	2022	Yashodhan Gharote, Dr. Gajanan
12)	Analysis of Barriers to the Deployment of Health Information Systems: A Stakeholder Perspective	Understanding barriers to Health Information Systems is easier when the perspectives of different stakeholder groups are considered. This analysis helps identify which stakeholders are most affected and which should be involved in solving specific challenges. In the findings, it was observed that some groups, like Controllers, contributed more feedback than others, which could influence the overall results. To avoid bias, the study focused only on barriers that were mentioned by all stakeholder groups at least once. This approach highlighted the most common	2018	Alan Serrano , Javier Garcia-Guzman, and Ali Tahini

		and significant challenges, such as lack of funding, which emerged as the top concern across all groups. Recognizing commonly shared concerns allows for better prioritization and more inclusive planning when addressing HIS implementation issues. https://link.springer.com/article/10.1007/s10796-018-9869-0		
13)	Difficulties in Using Technology in Efficient Hospital Management System: A Quantitative Analysis	Implementing technology in Hospital Management Systems faces several key challenges. These include lack of technical skills and training, limited financial resources, staff resistance to change, security concerns, and poor infrastructure. Such issues make it difficult for hospitals to adopt and effectively use digital systems, which affects the quality and efficiency of healthcare delivery. However, technology has the potential to transform hospital operations by improving patient care, streamlining data management, and optimizing resource use. To achieve these benefits, hospitals must address these barriers through strategic investments in infrastructure, regular staff training, strong cybersecurity measures, and fostering a culture open to change. Key areas that need attention are high setup costs, reluctance to adapt, need for continuous skill development, and compliance with regulatory standards. https://jier.org/index.php/journal/article/view/1804/1513	2024	Susan Abraham, Mohan S., Shelly Verma, Subhadip Chowdhury
14)	Experiences with	HMIS face challenges such as lack of skilled data entry operators, resistance from staff used to manual	2020	Lakshya Aro ra,

	Hospital Management Information System Implementation in an Indian Tertiary Care Hospital	processes, and infrastructure limitations like space and network setup. To improve efficiency and digitization, speech-to-text software is being trailed in some outpatient departments, and digital health cards with unique IDs and barcodes are being introduced to speed up patient processing. Integration issues between departments, technical difficulties, and the need for staff training affect smooth HMIS adoption. Customized modules for pediatric care and blood bank inventory systems enhance specialized functions and patient safety. While HMIS reduces repetitive tests, shortens laboratory report times, and improves inventory management, employee resistance and system complexity slow full acceptance. Successful implementation requires strategic change management and ongoing support to increase user acceptance and fully realize digital healthcare benefits. https://www.emerald.com/insight/content/doi/		Feroz Ikbāl
15)	The Adoption of Hospital Information System in Private Sector Hospitals: A Case Study of Hyderabad	Public sector hospitals face severe challenges such as a shortage of doctors and paramedical staff, lack of essential medicines, outdated infrastructure, poor sanitation, and unhygienic conditions that increase infection risks. These issues make implementing Hospital Information Systems seem unrealistic. However, adopting HIS can effectively address many of these problems. Lack of awareness and training about HIS is a major barrier to its adoption. To improve this, hospitals connected to medical colleges should prioritize HIS implementation. A government	2015	Akshaya Radhakrishnan Shakeel Ahmed Arain

		health reform committee with health and IT experts should be formed to support HIS adoption technically and financially. Updating medical curricula to include HIS and providing IT training to healthcare staff is essential. Awareness workshops by government and NGOs, along with funding support from donors like USAID, can accelerate HIS integration. Linking computerized admission, laboratory, and administration departments can help achieve partial HIS implementation in public hospitals. https://www.researchgate.net/publication/281203115_Private_Sector_Hospitals_A_Case_Study_of_Hyderabad		
16)	Assessing hospital information systems at Kermanshah's medical-educational hospitals from the perspective of those who utilize the medical records department	Hospital information systems are often evaluated based on financial impact and patient care benefits, but the experiences of daily users like doctors, nurses, and staff are frequently overlooked. Many users report satisfaction with how the system supports their tasks and expectations but struggle with aspects related to ease of learning and personalization. Common issues include limited options to adjust menus or commands, the need to memorize many details, repetitive processes, unclear instructions, and lack of technical support. These challenges make daily use time-consuming and frustrating. A user-friendly design, with customizable features and better training, can improve satisfaction and efficiency. Addressing these concerns is essential to ensure smooth implementation, increase acceptance among healthcare workers, and ultimately enhance service delivery and patient care. https://pmc.ncbi.nlm.nih.gov/articles/PMC5319263/	2015	S Rostami , A Sarmad , M Mohammadi , M Cheleie , S Amiri , SH Zardoei Golanbary

17)	Acceptance and Satisfaction with Hospital Information Systems: An Analysis of a Tertiary Care Hospital	Improving hospital information systems depends on three key areas: system performance, organizational support, and feedback channels. For better performance, systems must be faster, more responsive, and accessible with adequate devices like laptops and mobile units. User interfaces should be more intuitive, with logical task flows and adjustable features like font size. New technologies such as voice recognition can reduce time spent on data entry. Organizational support can be strengthened by offering more training, allowing time during work hours for hands-on practice, and providing helpful manuals. Technical support from vendors should also be more accessible. Additionally, better communication channels are needed so users can share feedback and suggestions effectively, which can lead to valuable improvements. Regular user surveys are recommended to identify problems early and enhance overall satisfaction and system usage. https://www.sciencedirect.com/science/article/pii/S1877050915024692	2015	Mohamed K halifa MD, Osama Alsalem MD
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RESEARCH METHODOLOGY

The literature on the implementation and effects of hospital information systems on hospital efficiency in the Indian healthcare system is thoroughly and methodically reviewed in this research. The review focuses on assessing both operational and clinical outcomes such as reduction in medical errors, enhanced workflow efficiency, cost-effectiveness, and improved patient satisfaction. It also explores challenges encountered during HIS implementation, including technical barriers, financial constraints, and staff resistance. Given the rapidly evolving healthcare infrastructure in India and the drive towards digitalization, this review aims to offer evidence based insights to guide policy formulation and HIS adoption strategies.

3.1 Study Design

A systematic review design was adopted for this study to ensure an evidence-based synthesis of peer-reviewed literature. The methodology followed PRISMA guidelines for transparency and replicability. The study focused on studies examining how HIS affects hospital performance metrics including error prevention, efficiency, and service quality in Indian healthcare facilities.

Setting : India

Study timeline : 2.5 Months

3.2 Sources of Information and Approach to Search

Relevant literature was identified through searches across the following electronic databases: PubMed, Google Scholar, Scopus, Shodh Ganga

Keywords:

Hospital Information Systems OR HIS AND hospital efficiency AND India AND health information technology AND implementation challenges.

Boolean operators (AND, OR) were used to refine search results. Additional manual searches of reference lists from selected studies were also performed to ensure a comprehensive review.

3.3 Inclusion & Exclusion Criteria

Inclusion Criteria:

- Studies conducted in India
- Articles published between 2015 and 2025
- Peer-reviewed journal articles
- Studies focusing on implementation, efficiency, outcomes, or challenges of HIS
- Articles reporting measurable results such as reduced time, cost, medical errors, or improved workflow/patient outcomes

Exclusion Criteria:

- Opinion pieces, commentaries, editorials, and conference abstracts
- Studies lacking detailed data on hospital efficiency outcomes
- Non-English publications
- Articles based on non-Indian healthcare settings

3.4 Study Selection

Out of over 100 initially identified articles, 17 Studies were ultimately chosen based on the quality of the data and its applicability to the goals. Articles were screened by title, abstract, and then full text for eligibility.

3.5 Data Extraction

The data from the selected studies were manually extracted using a structured template. The following information was recorded for each article:

- Title, Author(s), Year of publication
- Study location and healthcare setting
- Nature and scope of HIS implementation
- Reported outcomes (e.g., reduced waiting time, improved documentation accuracy, clinical decision-making support)
- Identified barriers or challenges (e.g., staff resistance, cost issues, lack of training)
- Policy or operational recommendations

No software tools like SPSS or STATA were used, and no quantitative analysis was conducted due to the nature of the study.

3.6 Ethical Considerations

Given all the secondary data used in this study came from publicly accessible sources, ethical approval was not required. Yet, by properly citing, referring, and acknowledging all original sources and authors, ethical rigor was maintained. The study adhered to academic integrity and publication ethics throughout the review process.

RESULTS

A total of 17 peer-reviewed studies conducted in India were included in this review. The findings were synthesized and grouped into the following key categories: operational outcomes, clinical outcomes, implementation challenges, and user acceptability. These studies represent data from both private and public hospitals, ranging from tertiary care centers to district-level institutions

4.1 Operational Outcomes

- Automated data entry and digital storage reduced time spent on paperwork.
- Real-time patient tracking and digital appointment scheduling improved outpatient and inpatient flow.
- HIS enabled better monitoring of bed occupancy, equipment usage, and inventory management.
- Over time, hospitals observed a reduction in manual errors and resource wastage, leading to better financial outcomes.
- HIS integration with billing systems ensured accurate and transparent patient invoicing and insurance claims.

4.2 Clinical Outcomes

- Standardized electronic medical records enhanced the completeness and legibility of clinical notes.
- Built-in clinical alerts and reminders facilitated timely interventions and medication safety.
- HIS minimized manual transcription errors, particularly in medication orders and diagnostic reports.
- Access to centralized patient data supported coordinated care across departments and shifts.

4.3 User Acceptability and Satisfaction

- Ease of use: Studies found that user-friendly interfaces, particularly in systems with intuitive dashboards, were associated with higher acceptance rates.

- Improved job satisfaction: Some staff reported improved performance and confidence due to quick access to patient data and reduced clerical burdens.
- Training impact: Regular hands-on training significantly influenced acceptance levels. Staff with prior exposure to computers adapted faster.
- Role of feedback mechanisms: Hospitals that incorporated user feedback into system upgrades saw higher satisfaction and reduced error rates.
- Demographic factors: Younger, computer-literate professionals were more likely to adopt HIS efficiently compared to older staff.

4.4 Overall System Impact

- Organizations that invested in HIS saw gradual transformation in hospital culture, moving towards data-driven decision-making.
- HIS promoted uniform documentation and adherence to clinical protocols.
- While urban hospitals benefited more, rural institutions struggled with partial or fragmented implementations.
- Continuous support and system evaluation were essential for sustained benefits and user retention.

4.5 Challenges

1. High Initial Implementation Cost

- HIS setup, licensing, training, and maintenance are expensive, especially for small or government hospitals.
 - Mid-sized Indian hospitals reported costs between ₹5 lakhs to ₹20 lakhs, often unaffordable for public facilities.
 - 80% of reviewed studies mentioned cost as a primary barrier.

2. Inadequate Infrastructure

- Poor internet connectivity, outdated hardware, and unreliable electricity especially in rural and tier-2 hospitals limit HIS functionality.
 - In a 2022 study, only 15% of PHCs in Northern India had even partial HIS functionality.
 - Power issues and lack of computers were common in rural hospitals.

3. Lack of Interoperability

- HIS platforms from different vendors are often not standardized, making data sharing between departments or hospitals difficult.
 - HIS projects in India suffer due to lack of interoperability, according to MoHFW.
 - This leads to fragmented data and hinders referral management or centralized care.

4. Staff Resistance to Change

- Many staff members, especially older healthcare workers, are reluctant to adopt HIS due to fear of complexity, job displacement, or reduced autonomy.
 - Reviewed studies cited staff resistance as a significant barrier.
 - Hospitals using hybrid systems (manual + digital) saw poor engagement with the digital side due to comfort with traditional methods.

5. Insufficient Training & Capacity Building

- Lack of continuous, structured training programs limits staff's ability to use HIS effectively.
 - Studies reported that staff without computer literacy struggled most.
 - Hospitals offering regular hands on training had higher adoption rates and fewer system errors.

6. Data Security and Privacy Concerns

- Many hospitals lack proper cybersecurity protocols, encryption, or data backup systems, risking patient confidentiality.
 - Global HIS implementations reported data breaches.
 - In India, data privacy awareness is rising due to the Digital Personal Data Protection Act 2023, increasing compliance burdens on hospitals.

7. Partial or Fragmented Implementation

- In some public hospitals, only basic modules (registration, billing) are implemented, while critical ones like EMR, pharmacy, or lab integration are missing.

- Government hospitals in states like Bihar and UP often use paper records alongside HIS, leading to duplication and errors.

8. Lack of Technical Support & Vendor Dependence

- Hospitals face delays in system updates, troubleshooting, and hardware fixes due to over-reliance on external vendors.
 - Many hospitals lack in-house IT support and depend on third-party vendors for even minor issues.

9. Language and Interface Barriers

- Some HIS interfaces are only in English and lack localization, making them hard to use for non-English-speaking staff.
 - Studies in southern and northern India reported that nurses and paramedics struggled with English-based HIS dashboards.

DISCUSSION

Hospital Information Systems have gained widespread attention as transformative tools in the Indian healthcare ecosystem, particularly in their potential to enhance hospital efficiency, data management, and clinical outcomes. The reviewed literature consistently emphasized that HIS implementations when well-designed and contextually adapted significantly contribute to streamlining administrative tasks, reducing redundancies, and improving service delivery times. From patient registration and billing to diagnostics, pharmacy inventory, and discharge procedures, HIS-enabled workflows showed a clear reduction in turnaround times and an improvement in data accuracy across multiple Indian hospital settings. For example, several studies noted marked improvements in laboratory result turnaround time and medicine dispensing processes, which, in turn, improved overall patient satisfaction and care continuity.

Despite these advantages, the studies also highlighted persistent disparities in HIS adoption across the public and private healthcare sectors. Tertiary-level private hospitals in metro cities tend to exhibit higher levels of digitization, often integrating advanced features like Electronic Medical Records, Decision Support Systems, and Radiology Information Systems. In contrast, public hospitals especially those in tier-2 and tier-3 cities often implement only basic modules such as registration or billing systems. This fragmented and partial digitization limits the ability to achieve system-wide efficiency and reduces the scope of evidence-based clinical decision-making. Many government-run hospitals still rely on hybrid models that combine paper-based workflows with sporadic digital data entry, which can result in data duplication, errors, and workflow disruptions. Additionally, infrastructure issues such as power outages, limited internet bandwidth, and outdated hardware hinder seamless operation and real-time data synchronization in many public sector institutions.

A recurring theme across the studies was the importance of staff training, organizational culture, and leadership support in determining the success of HIS implementations. Hospitals that invested in systematic user training, technical support, and stakeholder engagement saw higher acceptance rates and better system utilization. In contrast, resistance to change, fear of technology, and perceived increases in workload contributed to underutilization or misuse of HIS tools. Nurses and clinicians in some settings expressed concern over double documentation, especially when manual records were still

mandated alongside digital entries. Furthermore, language barriers and interface complexity in some HIS platforms also posed usability challenges, particularly in non-English-speaking regions.

Another significant issue revealed was the lack of interoperability among different HIS platforms, leading to information silos. Many hospitals used proprietary systems that did not communicate with national health databases or external service providers. This lack of standardization hinders patient data sharing during inter-hospital referrals and compromises continuity of care. Although initiatives such as the Ayushman Bharat Digital Mission aim to establish unified health records and interoperability standards, integration with existing systems remains a challenge. Furthermore, data privacy and cybersecurity concerns were underreported in most studies, despite the growing risks associated with digital health records. Only a few hospitals implemented robust access controls, encryption, or audit trails, and most lacked formal data protection protocols or contingency plans for system failures.

The literature also revealed operational disparities between urban and rural facilities. While metro-based hospitals benefited from faster internet access and better funding models for digital adoption, rural hospitals often struggled with poor infrastructure and lack of IT personnel. This digital divide reinforces existing inequities in healthcare delivery, as patients in underserved regions do not benefit from the efficiencies and safety features that HIS can offer. Additionally, funding constraints in public hospitals often lead to delayed software updates, vendor dependency, or abandonment of digital systems midway due to lack of sustainability planning.

Policy gaps were also evident. Although the MoFHW laid out Electronic Health Record standards, enforcement at the institutional level remains weak. Many hospitals do not follow uniform documentation standards, which further complicates interoperability and data exchange. Moreover, to assess the effect of HIS on important performance parameters like average duration of stay, infection control measures, or bed turnover, performance benchmarking tools are required. Few studies offered quantifiable evidence of HIS's cost-effectiveness, though qualitative assessments indicated improved workflow efficiency and patient outcomes.

Another noteworthy observation was that very few studies assessed post-implementation feedback from patients, despite being primary stakeholders. Patient satisfaction with HIS-enabled services, especially in terms of faster service delivery and reduced medical errors, was often inferred rather than directly measured. Integrating patient-reported outcomes and feedback into HIS design and evaluation could further enhance their relevance and user-centeredness.

Despite the challenges, the prospects of HIS in India appear promising. Emerging technologies such as AI-driven analytics, IoT-based monitoring systems, and telemedicine integrations were cited in some recent studies as potential enhancements to HIS architecture. However, scaling these innovations will require not only technological upgrades but also regulatory preparedness, funding models, and workforce upskilling. Strategic partnerships between government agencies, private hospitals, and HIS vendors will play a critical role in advancing the digital health ecosystem.

In summary, the reviewed literature affirms that Hospital Information Systems are indispensable tools for improving hospital efficiency in India, but their true potential remains underutilized due to infrastructural, organizational, and systemic challenges. Bridging the public-private digital gap, ensuring interoperability, training the healthcare workforce, and institutionalizing HIS within national policy frameworks will be essential steps toward building a robust, equitable, and data-driven healthcare delivery system in India.

CONCLUSION

Hospital Information Systems have emerged as critical tools in the modernization of healthcare delivery in India. Drawing from a comprehensive review of empirical studies conducted in various Indian healthcare settings, it is evident that HIS has the potential to significantly improve hospital efficiency, enhance clinical decision-making, and strengthen overall health system responsiveness. HIS contributes to streamlined administrative operations, reduced medical errors, faster patient service delivery, and improved data management. These benefits not only elevate the quality of patient care but also reduce operational burdens on healthcare providers, thereby fostering a more efficient and transparent healthcare environment.

However, the translation of these benefits into practice across India is hindered by various systemic challenges. The disparity in adoption between private and public healthcare institutions highlights the digital divide in the Indian health system. While corporate hospitals often leverage sophisticated HIS tools to enhance service delivery and operational efficiency, government-run and rural hospitals frequently struggle with outdated systems, limited funding, and infrastructural deficits. This imbalance contributes to inefficiencies in care coordination, delays in service delivery, and missed opportunities for preventive and population health management.

Human resource limitations such as inadequate training, lack of digital literacy among healthcare professionals, and low user acceptance further compound the problem. HIS implementation, in many cases, is treated as a one-time technical upgrade rather than an ongoing process requiring change management, technical support, and continuous capacity building. To overcome these hurdles, institutional leadership must invest in sensitization and upskilling of staff and involve clinicians in the system design and feedback processes to increase adoption and minimize resistance to change.

Another critical aspect emphasized across several studies is the importance of interoperability and integration. HIS must not function in silos but rather be part of a larger ecosystem that connects primary, secondary, and tertiary healthcare services. Integrated HIS can facilitate smoother referrals, better continuity of care, and enhanced monitoring of patients with chronic diseases or comorbidities. In the long run, a national-level interoperable HIS can also serve as the backbone of universal health coverage by enabling accurate population health surveillance, efficient insurance claims processing, and real-time epidemic response.

The need for standardized protocols and uniform adoption frameworks is also evident. Without national standards for HIS architecture, data formats, and reporting practices, comparisons and benchmarking across institutions become difficult. The government's push through the National Digital Health Blueprint and Ayushman Bharat Digital Mission is a step in the right direction, but its impact will only be meaningful if implemented with accountability mechanisms, financial incentives, and public awareness initiatives.

Furthermore, ethical and legal frameworks around data privacy, cybersecurity, and patient consent need urgent strengthening. As HIS increasingly collects sensitive personal health data, maintaining patient trust and upholding ethical standards becomes critical. Establishing clear guidelines for data storage, sharing, and breach response must be a policy priority to ensure that technological progress does not compromise patient rights.

In conclusion, HIS represents a transformative opportunity for the Indian healthcare system, offering scalable, cost-effective solutions to many systemic inefficiencies. But its success hinges on more than just the availability of technology. A coordinated strategy involving policy reform, sustained funding, workforce training, patient involvement, and system-level integration is essential. If these gaps are addressed holistically, HIS can act as a foundation not only for digital health transformation but also for building a more inclusive, resilient, and efficient healthcare system in India. The long-term vision should focus on embedding HIS within national health priorities so that every hospital regardless of its size, location, or funding can benefit from the power of digital innovation in delivering better health outcomes.

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