Dissertation Training

at

TENON FM

A REPORT ON

"Role of Hospital Management Information Systems (HMIS) in Hospital Efficiency and Patient Care in Indian Hospitals: A Systematic Literature Review"

By

CHAHAT YADAV

PG/24/025

Under the guidance of

Dr. Vinay Tripathi

PGDM (Hospital & Health Management)

2024–26



International Institute of Health Management Research

New Delhi

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HMIS AND HOSPITAL EFFICIENCY IN INDIA

CERTIFICATE OF COMPLETION

The certificate is awarded to

Chahat Yadav

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Senior Executive HR
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HMIS AND HOSPITAL EFFICIENCY IN INDIA

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Associate Professor
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CERTIFICATE BY STUDENT

It is hereby certified that the above mentioned dissertation title "Role Of HMIS In Hospital Efficiency And Patient Care In Indian Hospitals: A Systematic Literature Review" submitted by Chahat Yadav, Enrollment No. PG/24/025 under the guidance of Dr. Vinay Tripathi for award of PGDM (Hospital & Health Management) of the Institute carried out during the period from 1st April 2026 to 1st July 2026 contains my own efforts and has not been used for awarding any other degree/diploma/associate ship/fellowship/titles at this institute or any other institution of higher learning.

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Deliverables: Conducted an extensive literature review on HMIS, analysed peer-reviewed research articles, prepared thematic evidence synthesis, developed literature matrices, created research tables, figures and diagrams, supported healthcare management research activities and completed the dissertation with the prescribed timeline.

Strengths: He has demonstrated strong research and analytical skills, critical thinking, attention to detail, effective communication, teamwork and a proactive approach towards learning and completing assigned responsibilities.

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Suggestions for Institute: None

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ABOUT THE ORGANISATION

Tenon FM is one of India's leading Integrated Facility Management (IFM) companies and a business vertical of the Tenon Group, founded in 1995 by Maj. Manjit Rajain. Tenon FM was incepted in 2008 and delivers integrated facility management and security-linked support services to more than 3,100 clients across India, the UK and Germany, spanning sectors such as IT/ITeS, Telecom, Retail & E-commerce, Healthcare, BFSI and Education. Its national footprint spans 4,000+ tier 1, 2 and 3 cities and 19,000+ serviced sites, supported by a workforce of 35,000+ professionals across 78+ branch offices.

The company operates on a “Self-Performance” model, delivering services in-house through its own trained workforce rather than through sub-contracted outsourcing, supported by two proprietary digital platforms: Tenon Connect, a mobile governance tool for field-force management, and M-NEO, an SLA and business-operations management platform. Its mission is “to provide world-class Integrated Facility Management and Security services, where excellence in service delivery, environmental sustainability and technological innovation converge seamlessly.” Tenon FM is ISO 14001:2015 and ISO 45001:2018 certified and holds a BBB+ credit rating from FITCH.

Tenon FM offers 60+ service lines across four broad categories: Soft Services (housekeeping, front office, landscaping, pest control), Facilities Support Services (payroll, statutory compliance, MIS reporting, procurement), Mechanical & Electrical Services (HVAC, fire systems, energy audits, critical systems management), and Express Cleaning Services (specialised and post-construction cleaning, disinfection). This internship and dissertation were carried out at Tenon FM, providing the organisational context for the present study.

HMIS AND HOSPITAL EFFICIENCY IN INDIA

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I would like to express my sincere gratitude to my mentor, Dr. Vinay Tripathi, Associate Professor, IIHMR Delhi, for his exceptional guidance, constant encouragement and unwavering support throughout the course of my dissertation. His insights, constructive feedback and academic mentorship have been instrumental in shaping the direction and quality of this research.

This study was undertaken independently under his supervision and I feel privileged to have the opportunity to learn from his vast experience in the field of public health and health management. His timely reviews, detailed observations and ability to simplify complex concepts greatly helped me in refining the study and deepening my understanding of the subject.

I also extend my thanks to the faculty members and administrative staff at IIHMR Delhi for providing a conducive academic environment and necessary resources for the successful completion of this work. Their support, directly and indirectly contributed to my overall learning experience during the course of this program.

Chahat Yadav

PG/24/025

ABSTRACT

Hospital Management Information Systems (HMIS) have become a central pillar of digital transformation in healthcare, offering hospitals an integrated platform to manage clinical, administrative and financial operations. This dissertation presents a systematic literature review examining the impact of HMIS on hospital efficiency and patient care in Indian hospitals. Following the PRISMA framework, records were identified through Google Scholar, Scopus and PubMed, supplemented by relevant Indian government policy documents. After removing duplicates and applying inclusion and exclusion criteria across title/abstract and full-text screening stages, 36 studies were included in the final review — 30 identified through systematic database search (Google Scholar, Scopus, PubMed) and a further 6 India-specific studies added via targeted supplementary hand-search to strengthen the evidence base directly relevant to the Indian hospital context. Findings were synthesised thematically across five domains: operational efficiency, quality and safety of patient care, workflow management, user satisfaction, and implementation barriers. The review finds that HMIS adoption is associated with reduced administrative workload, improved patient throughput, more complete clinical documentation, fewer medication errors and better continuity of care, while implementation continues to be constrained by infrastructure gaps, budget limitations, resistance to change among staff and inconsistent interoperability standards. The study concludes that HMIS is a strategically valuable tool for Indian healthcare organisations, provided that adoption is supported by adequate training, phased rollout, strong leadership and continued alignment with national digital health initiatives such as the Ayushman Bharat Digital Mission (ABDM). Recommendations for practice and directions for future research are presented.

Keywords: Hospital Management Information System, HMIS, hospital efficiency, patient care, digital health, India, systematic review, Ayushman Bharat Digital Mission.

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ABBREVIATIONS

HMIS	Hospital Management Information System
HIS	Hospital Information System
EHR	Electronic Health Record
EMR	Electronic Medical Record
ABDM	Ayushman Bharat Digital Mission
NDHM	National Digital Health Mission
WHO	World Health Organization
TAM	Technology Acceptance Model
UTAUT	Unified Theory of Acceptance and Use of Technology
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
LIS	Laboratory Information System
RIS	Radiology Information System
PACS	Picture Archiving and Communication System
CPOE	Computerized Provider Order Entry
CDSS	Clinical Decision Support System
HOT-fit	Human, Organization, and Technology-fit (evaluation framework)

CHAPTER 1: INTRODUCTION

1.1 Background of the Study

With the introduction of information and communication technology, the healthcare business is undergoing a digital transformation around the world. Healthcare companies are searching for digital solutions that may increase operational efficiency, enhance clinical decision making, reduce medical errors and offer more patient-centred care. Technology in health administration has altered the way hospitals collect, store, process and use information for administrative and therapeutic purposes. Of the various digital healthcare technologies that are driving the modernisation of healthcare, Hospital Management Information Systems (HMIS) is one of the key developments.

In the current healthcare scenario, hospitals generate a vast quantity of information relevant to patient records, diagnostic reports, treatment plans, financial transactions, inventory management, human resource administration and regulatory compliance. Manually managing this information is time-intensive and error-prone. Traditional paper-based systems can no longer meet the needs of modern healthcare delivery as hospitals grow larger and more complex. Therefore, healthcare organisations across the world are heavily investing in information technologies to optimise their operations and improve service delivery.

Hospital Management Information System (HMIS) is an integrated software application that facilitates the management of the clinical, administrative, financial and operational procedures of a healthcare organisation. It aids in the collection, storage, retrieval and sharing of healthcare information among departments and stakeholders. HMIS integrates various hospital services — patient registration, appointment management, electronic health records (EHR), billing and finance, laboratory information systems, radiology management,

pharmacy management, inventory management, human resource management and management reporting — within a single digital system. This connection provides hospitals with more efficient, accurate, transparent and cross-departmental coordination.

In industrialised countries, the use of hospital information systems has significantly improved healthcare delivery through enhanced communication among healthcare workers, increased patient safety, decreased delays in treatment and better utilisation of resources. Such benefits have driven the healthcare business to use information technology as a strategic tool for organisational progress and healthcare improvement worldwide.

Over the last decade, the healthcare business in India has experienced tremendous growth, driven by increasing healthcare investment, technological innovation, urbanisation and government initiatives to improve healthcare infrastructure. However, the industry still faces various difficulties despite this progress, such as insufficient infrastructure, shortage of labour, fragmented healthcare delivery, and inefficiencies in information management. In India, most hospitals — especially in rural and semi-urban areas — still depend on manual or semi-computerised systems for health information administration, which are often associated with delays in patient registration, difficulty in accessing medical records, duplication of paperwork, poor communication between departments and increased administrative burden for healthcare providers.

The digitalisation of healthcare became even more vital during the COVID-19 pandemic, which revealed weaknesses in healthcare systems worldwide and underscored the importance of resilient digital infrastructure. Hospitals with digital information systems were generally better prepared to respond to the surge in patient data management, resource-usage

monitoring and staff coordination than hospitals relying predominantly on manual operations.

The Government of India has initiated several programmes to promote digital health, most notably the National Digital Health Mission (NDHM), launched in 2021 and later merged into the Ayushman Bharat Digital Mission (ABDM). The aim is to build interoperable digital platforms that enable secure and efficient sharing of healthcare information, creating a holistic digital health ecosystem. Implementation of HMIS at the hospital level is closely aligned with the goals of these national digital health programmes.

A number of benefits have been associated with HMIS deployment. At the operational level, HMIS adds to operational efficiency by reducing paperwork, automating administrative duties, reducing duplication of effort and improving resource management. Clinically, HMIS improves the quality of patient care by giving better access to patient information, clinical decision support, reduced medication errors and improved continuity of care. However, despite these advantages, HMIS deployment remains a complex undertaking: it requires substantial organisational change, including workflow modification, staff training, infrastructure development and cultural change. A recognised impediment to successful implementation is resistance to change among healthcare professionals, who may see digital technology as disruptive, particularly where adequate training and technical support are not provided. Budget constraints are a further major challenge, since the cost of purchasing, installing, customising and maintaining HMIS is high, and smaller hospitals often lack sufficient financial resources.

Given the increasing number of patients with chronic and complex conditions and the growing role of technology in healthcare delivery, it becomes important to understand the

effect that HMIS has had on healthcare delivery. This study therefore examines the impact of HMIS on hospital efficiency and patient care within the Indian healthcare system through a systematic review of the existing literature.

1.2 Problem Statement

The healthcare industry in India is rapidly adopting digital technologies to improve service delivery, patient outcomes and operational efficiency, and HMIS has become a vital tool for computerising clinical, administrative and financial activities in hospitals. However, while the use of HMIS in Indian hospitals is increasing, robust, consolidated evidence of its effect on hospital efficiency and patient care remains limited. Much of the current research focuses on implementation issues, adoption barriers and policy interventions rather than taking a holistic view of organisational and clinical outcomes. There is, in particular, a lack of research on how user satisfaction and workflow management jointly influence the overall effectiveness of HMIS. It is therefore important to understand the impact of HMIS on hospital efficiency and patient care in Indian hospitals through a systematic review of the available literature.

1.3 Rationale of the Study

Digital transformation in healthcare is driven by both technological innovation and government initiatives such as the Ayushman Bharat Digital Mission (ABDM). Hospitals are investing considerably in HMIS to increase efficiency, reduce costs, improve the quality of patient care and support evidence-based decision-making. Yet barriers to successful implementation persist, including infrastructure limitations, resistance to change, training deficits and interoperability concerns. It is therefore important for healthcare administrators, policymakers and practitioners to understand both the benefits and the challenges associated

with HMIS. This study reviews the evidence on HMIS implementation and its impact on hospital performance and patient-care outcomes in India.

1.4 Research Questions

Main Research Question: What is the impact of Hospital Management Information Systems (HMIS) on hospital efficiency and patient care in Indian hospitals?

- RQ1: How does HMIS help improve operational efficiency in hospitals?
- RQ2: How does HMIS affect the quality of patient care and patient safety?
- RQ3: What is the impact of HMIS on workflow management and collaboration among hospital departments?
- RQ4: What factors influence user satisfaction and acceptability of HMIS among healthcare professionals?
- RQ5: What are the main problems and barriers to HMIS implementation?

1.5 Aim and Objectives of the Study

Main Aim

To study the role of Hospital Management Information Systems (HMIS) in the effectiveness of hospitals and patient care in Indian hospitals, through a detailed systematic review of the available peer-reviewed literature and published studies.

Secondary Objectives

- To identify and document the specific advantages of HMIS in improving the operational efficiency of hospitals, including reductions in paperwork, patient-processing time and improved resource allocation.

- To evaluate and document the role of HMIS in improving the quality of patient care, including patient safety, accuracy and completeness of medical records, medication safety and continuity of care.
- To identify, categorise and assess the primary difficulties and limitations faced by Indian hospitals during HMIS deployment, including technological, organisational, budgetary and human-resource factors.
- To assess the effect of HMIS on workflow management, inter-departmental communication, care coordination and overall healthcare service delivery.
- To study user-acceptance rates and satisfaction levels among staff, and to determine the key success factors for the acceptability and sustainability of HMIS in the Indian healthcare system.
- To develop evidence-based recommendations and best practices for the successful adoption, optimisation and change management of HMIS in Indian hospitals.

1.6 Significance of the Study

Scholarly Contribution

This study contributes to the existing body of knowledge by synthesising the available information on HMIS implementation and outcomes in the Indian healthcare system.

Relevance to Management

The findings may help hospital management make informed decisions about HMIS investment, deployment and optimisation approaches.

Implications for Policy

The study provides evidence on the effectiveness of digital health programmes such as ABDM and NDHM, which can help inform related policy decisions.

1.7 Scope of the Study

This study is limited to a systematic review of secondary literature (peer-reviewed journal articles, systematic reviews, official government publications and policy documents) published between 2018 and 2026, concerning HMIS, hospital information systems and related health information technologies deployed in hospital settings, with particular attention to evidence from the Indian healthcare context.

1.8 Conceptual Framework

The conceptual framework guiding this study proposes that the implementation of HMIS influences hospital efficiency and the quality of patient care through two intermediate mechanisms — workflow management and user satisfaction — and that this relationship is moderated by organisational factors such as staff training, infrastructure availability and management support.

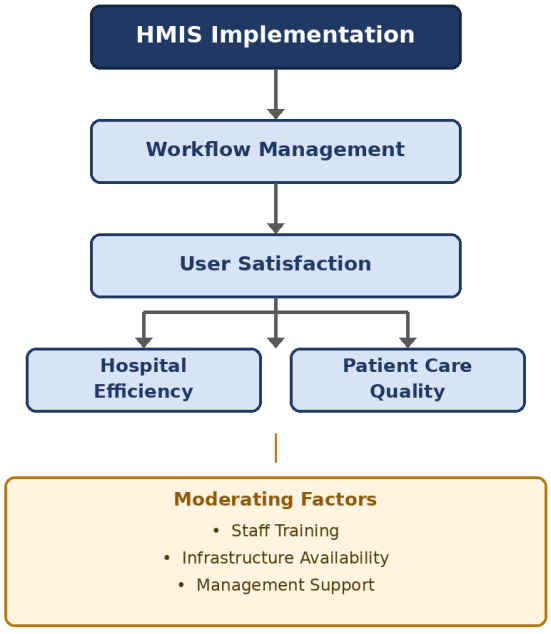


Figure 1.1: Conceptual Framework of the Study

The conceptual framework highlights that HMIS implementation influences hospital efficiency and the quality of care received by patients through enhanced workflow

management and user satisfaction. Organisational factors such as infrastructure availability, managerial support and staff training strengthen or weaken this relationship.

CHAPTER 2: REVIEW OF LITERATURE

2.1 Introduction

This chapter reviews the available literature on Hospital Management Information Systems, their implementation approaches, demonstrated advantages and implementation constraints. The central aim of this chapter is to offer a thorough understanding of HMIS within the present healthcare context, with particular focus on evidence and case studies relevant to the Indian healthcare system.

The chapter is organised thematically rather than chronologically, since the research questions set out in Chapter 1 are themselves thematic (operational efficiency, quality of patient care, workflow management, user satisfaction, and implementation barriers). Section 2.2 traces the historical development of hospital information systems; Section 2.3 describes the functional modules that make up a modern HMIS; Sections 2.4 and 2.5 review the evidence on operational and clinical outcomes respectively; Section 2.6 reviews implementation barriers; Section 2.7 reviews critical success factors; Section 2.8 reviews the technology-acceptance theories used to explain adoption; Section 2.9 focuses specifically on Indian evidence; and Section 2.10 synthesises the chapter before the research gap is set out in Section 2.12.

2.2 Development of Hospital Information Systems in Health Care

Much has been done over the past four decades to develop healthcare information systems capable of handling the changing information needs of healthcare organisations and the changing capabilities of technology. The first hospital systems were developed in the 1980s and 1990s, mainly for billing, accounting and administrative functions with limited clinical capacity (1). These early systems were built in silos, with little or no connectivity between departments, leading to duplication, data inconsistencies and operational inefficiencies.

In the 2000s, integrated hospital information systems began to emerge, made possible by the development of network technologies, relational databases and web-based architectures capable of linking multiple clinical and administrative departments and offering near real-time data access (2). More sophisticated HMIS solutions began linking patient registration, billing, pharmacy, laboratory and basic clinical information.

In developed countries, hospital information systems have grown into sophisticated electronic health record (EHR) systems that comprehensively integrate clinical, administrative, financial and operational data, increasingly incorporating cloud computing, mobile applications, analytics, clinical decision support and interoperability standards. The WHO's Global Strategy on Digital Health (2020–2025) underscores the strategic importance of integrated digital health systems in achieving universal health coverage and improved health outcomes worldwide (3). This was subsequently reinforced through the WHO's Global Initiative on Digital Health, launched to coordinate country-level digital health investment around a shared set of technical and governance standards and reduce duplication of effort between national digital health programmes (4). Together, these global frameworks signal that hospital-level HMIS decisions are increasingly expected to be compatible with national and international digital health architecture, rather than being purely internal IT choices.

The development and implementation of hospital information systems in India has followed a different trajectory from that in industrialised countries. Leading commercial hospital chains and large urban tertiary care centres have rapidly deployed sophisticated HMIS and EHR systems, while many secondary and tertiary hospitals have only basic or partially integrated systems, and primary health facilities and rural hospitals — which serve the majority of India's population — remain largely manual or semi-computerised.

A national US survey of acute-care hospitals found that, even in a high-income setting with substantial healthcare IT investment, comprehensive EHR adoption remained low in the late 2000s, with cost, physician resistance and inadequate technical support identified as the top barriers (5). This finding is instructive for India: it shows that the pace of digital adoption is shaped less by the availability of technology itself and more by financing models, workforce readiness and institutional support structures — factors that are, if anything, more constrained in the Indian public and semi-private hospital sector.

At the policy level, the Government of India's National Digital Health Mission (NDHM) strategy sets out a phased approach to building interoperable digital building blocks — including a unique Health ID, a Healthcare Professionals Registry and a Health Facility Registry — intended to link individual hospital-level systems into a unified national digital health ecosystem (6). Hospital-level HMIS deployment in India is therefore increasingly expected to align with this national architecture rather than operate as a standalone system, which adds an additional layer of technical and regulatory complexity beyond what earlier-generation hospital information systems in other countries had to contend with.

2.3 HMIS Functional Modules and Components

A complete and well-designed HMIS consists of a number of integrated modules, each performing distinct and vital functions in a hospital's operations:

- Patient Registration and Management: registration, demographic data collection, appointment scheduling and maintenance of out-patient and in-patient records.
- Electronic Health Record (EHR): digital documentation of a patient's medical history, clinical notes, diagnoses, prescriptions, treatment plans and test results, supporting continuity of care across encounters.

- Billing and Finance: automated patient billing, insurance-claims processing, revenue tracking, cost accounting and financial reporting.
- Pharmacy Management: medication inventory, drug dispensing, adverse drug-interaction screening and medication-safety features.
- Laboratory Information System (LIS): processes test orders, tracks specimens, and generates and reports results, integrated with the main HMIS for rapid clinician access.
- Radiology Information System (RIS) / PACS: manages imaging requests, archives and retrieves images, and generates radiology reports.
- Inventory and Supply Chain Management: real-time tracking of consumables, pharmaceutical stock and equipment, supporting automatic reordering and waste reduction.
- Human Resources Management: staff records, scheduling, payroll, attendance and performance evaluation.

An effective combination of these modules is a key prerequisite for realising the full operational potential of HMIS (7). Research indicates that hospitals with well-connected systems tend to be more efficient and cost-effective, and provide a better level of departmental service, than hospitals with isolated or poorly integrated systems.

It is worth noting that the degree of module integration achieved varies considerably across the hospitals described in the literature. At one end of the spectrum, some facilities operate a single, vendor-supplied HMIS platform in which all modules share a common patient identifier and database, enabling genuinely real-time cross-departmental visibility. At the

other end, many hospitals — particularly in the Indian secondary-care segment — operate a patchwork of separate, poorly integrated systems: a billing package purchased from one vendor, a laboratory information system from another, and paper-based registers for pharmacy or inventory management. This partial-integration scenario is common enough in the literature that it merits treatment as a distinct category, rather than as a simple midpoint between "no HMIS" and "fully integrated HMIS." Partial integration can, in some cases, introduce new inefficiencies of its own — for example, duplicate data entry across systems that do not communicate with each other — that would not exist under either a fully manual or a fully integrated system, a nuance that is not always captured in studies that treat HMIS adoption as a simple binary (adopted vs. not adopted).

For an organisation such as Tenon FM, which provides integrated facility management support (including MIS reporting and space and asset management services) to client organisations across sectors including healthcare, this module-level view of HMIS is a useful frame of reference: the same underlying logic of module integration — shared data, reduced duplication, real-time cross-functional visibility — that determines HMIS effectiveness in a hospital setting also determines the effectiveness of the facilities and operations management systems used in non-hospital client environments.

2.4 HMIS and Operational Effectiveness

The need for operational efficiency has been a key driver of HMIS deployment in hospitals internationally. A body of research has documented measurable improvements in efficiency across hospital operations and departments, including:

- Reduced paper and administrative workload as hospitals move from paper-based processes to digital records and workflows.

- Improved patient throughput through automated registration, scheduling and check-in.
- Better resource planning through real-time data on bed occupancy, equipment use and departmental workloads.
- Inventory optimisation and cost control through automated stock tracking.
- Improved inter-departmental communication and coordination through a shared platform.
- Fewer administrative and clerical errors through standardised, automated workflows.

Empirical evidence from an Indian hospital-based study similarly found that integrated hospital management systems reduce administrative workload, improve resource utilisation and speed up service delivery, contributing to measurable gains in operational efficiency and patient satisfaction (8). These efficiency benefits are especially relevant to the Indian healthcare system, which typically manages a large patient load with comparatively limited human and physical resources.

A methodological point that recurs across this body of literature is the difficulty of isolating the specific contribution of HMIS to efficiency gains from other, simultaneous changes that hospitals often undertake alongside a digital transformation — such as physical infrastructure upgrades, staffing changes, or revised clinical protocols. Relatively few of the studies reviewed employ a genuinely controlled before-and-after design with a comparable non-adopting facility; most rely instead on self-reported perceptions of improvement, or on before-and-after comparisons within a single hospital without a control group. This is not

necessarily a fatal weakness — randomised or even quasi-experimental designs are difficult to implement in a live hospital setting — but it does mean that the efficiency gains reported in the literature should be interpreted as suggestive and directionally consistent, rather than as precise, causally isolated effect sizes.

2.5 Impact of HMIS on Quality and Safety of Patient Care

HMIS implementation has also been linked to improvements in the quality and safety of patient care:

- Accuracy and completeness of medical records: electronic records are more legible, complete and accessible than paper records, reducing the likelihood of errors caused by illegible handwriting or missing information.
- Improved medication safety: computerised provider order entry (CPOE), combined with clinical decision support, has been associated with substantial reductions in prescribing errors — including an estimated 48% reduction in the likelihood of a prescribing error (9) and an 85% reduction in medication-prescribing error rates with a corresponding fall in ICU mortality (10).
- Improved clinical decision support: comprehensive, integrated patient history, lab results and clinical guidelines enable more informed, evidence-based clinical decisions.
- Better continuity of care: electronic records available across departments and facilities improve continuity, particularly for patients with long-term conditions.
- Higher-quality inpatient outcomes: greater clinical-IT automation has been associated with lower inpatient mortality and fewer complications (11).

From the perspective of clinical staff, hospital information system use is associated with improved documentation practices and a perceived improvement in overall care quality, alongside better inter-provider communication (12).

The medication-safety evidence in particular deserves closer scrutiny, since it produces some of the largest reported effect sizes in the entire body of literature reviewed for this dissertation — a near halving, and in one meta-analysis a near nine-tenths reduction, in prescribing-error rates. Two considerations temper how directly these findings should be extrapolated to the Indian hospital context. First, both of the studies reporting these figures were conducted in well-resourced health systems (the United States and a set of predominantly high-income intensive care units) with mature computerised provider order entry and clinical decision-support infrastructure already in place; the marginal safety gain from introducing CPOE into a hospital that currently has no electronic prescribing system at all may differ from the marginal gain of refining an already-partially-digital system. Second, medication-error reduction depends not only on the presence of CPOE software but on the quality and completeness of the underlying drug-interaction and allergy databases the software checks against — a data-quality dependency that is itself vulnerable to the infrastructure and training barriers discussed later in this chapter. The direction of the effect (CPOE and clinical decision support reduce medication errors) is well supported by the literature; the precise magnitude of that effect in an Indian hospital setting remains an open empirical question.

2.6 Barriers and Challenges to HMIS Implementation

Despite its recognised advantages, HMIS implementation is accompanied by significant challenges, particularly in the Indian healthcare context. Commonly reported barriers in the peer-reviewed literature include:

- Resistance to change among healthcare workers: physicians and senior clinical staff are frequently reluctant to adopt HMIS due to concerns about workflow disruption, increased workload during transition and loss of professional autonomy (1).
- Inadequate training and technical support, leading to low adoption and underuse of advanced system features.
- High cost of installation and maintenance, which is particularly difficult for small hospitals and public health centres with limited IT budgets (13).
- Technical and system-integration challenges, including compatibility issues between modules and legacy systems.
- Data security and privacy concerns, which are more acute in resource-constrained settings lacking dedicated IT security infrastructure.
- Poor infrastructure — including unreliable electricity, limited IT support staff and intermittent internet connectivity — in rural and remote areas.
- Weak organisational readiness and change-management capability in many hospitals.
- Interoperability and standardisation gaps between HMIS vendors and platforms, which increase the cost and difficulty of data sharing between facilities (14).

A systematic review of barriers to EHR and HIT adoption identified facilitating conditions, cost and training availability as consistent predictors of successful adoption across settings (15). In the Indian context specifically, financial constraints and inadequate IT infrastructure remain particularly significant contextual barriers.

Evidence from other low-resource public hospital settings reinforces this picture: a cross-sectional study of public hospitals in Southern Angola found that HIS use to support clinical and managerial decision-making was substantially limited by unreliable infrastructure and inconsistent data quality, even where systems had nominally been deployed (16). This is a useful comparator for the Indian public hospital sector, where similar infrastructure and data-quality constraints have been widely reported anecdotally but are less frequently quantified in the peer-reviewed literature. It suggests that simply installing HMIS software is not sufficient; without parallel investment in reliable power supply, network connectivity and data governance, the anticipated efficiency and quality gains may not materialise, or may materialise only partially and inconsistently across facilities within the same health system.

Taken together, the barriers identified in the literature can be grouped into four broad categories: (a) financial barriers (capital cost, ongoing maintenance, and opportunity cost of staff time during transition); (b) technical barriers (legacy system compatibility, interoperability, infrastructure reliability); (c) human and organisational barriers (resistance to change, inadequate training, weak change-management capability); and (d) governance barriers (data security and privacy concerns, unclear accountability for data quality). Most of the reviewed studies address only one or two of these categories in depth, which points to a need for research that treats HMIS implementation as a genuinely multi-dimensional organisational change process rather than a purely technical rollout.

2.7 Critical Success Factors and User Adoption

The ultimate success of HMIS implementation depends on user acceptance and continued use. Research identifies several factors that support successful and sustainable HMIS implementation:

- Strong leadership and organisational support, with a clear digital-transformation strategy and appropriate budget allocation.
- Comprehensive, role-specific training and skill-building for different user groups (17).
- A phased and incremental implementation approach, beginning with departments more open to change.
- Structured change management and communication, involving end users in planning and clearly explaining benefits and timelines.
- Meaningful involvement of end users in vendor selection and system customisation decisions.
- Dedicated post-implementation technical support for at least six to twelve months after launch.
- Clear data-quality standards and accountability from the outset.
- Early demonstration of tangible benefits (e.g. reduced waiting times, faster lab results) to build user confidence.

Evidence from a single-hospital study of physician EHR acceptance similarly found that ease of use and, critically, the degree to which the system fit into existing clinical workflow — rather than the sophistication of the system's features — were the strongest determinants of day-to-day physician acceptance (18). This reinforces a recurring theme across the critical-success-factor literature: acceptance is driven less by what a system can technically do and more by how naturally it integrates into the working routines of the people who must use it every day.

Evidence from a tertiary-care case study confirms that user-friendly interfaces, adequate training and visible support significantly increase HIS acceptance and satisfaction (19). In the Indian setting specifically, systems developed with the involvement of local clinicians and adapted to existing workflows achieve considerably higher acceptance than systems imposed with little local input.

A further point emerging across this body of literature is the distinction between initial adoption and sustained use. Several studies report reasonably high initial uptake immediately following training and go-live support, followed by a decline in engagement once dedicated implementation support is withdrawn. This suggests that critical success factors should be understood not as a one-time checklist completed during rollout, but as an ongoing set of organisational commitments — refresher training, continued technical support, and periodic review of workflow fit — that must be sustained well beyond the initial implementation period if early gains in efficiency and care quality are to be maintained.

2.8 Technology Acceptance Models in Healthcare

Several adoption theories and models have been developed to describe and predict user adoption of health information systems, and these are useful in guiding the development and implementation of HMIS in healthcare organisations.

The Technology Acceptance Model (TAM), developed by Davis (1989), proposes that technology acceptability is mostly determined by two criteria: perceived ease of use and perceived usefulness. Applications of TAM in the HMIS adoption context confirm that systems perceived as both valuable and easy to use are more likely to be adopted (20).

The Unified Theory of Acceptance and Use of Technology (UTAUT) extends TAM with additional constructs — performance expectancy, effort expectancy, social influence and

facilitating conditions (21). Applications of UTAUT in hospital settings confirm that all four constructs are significant predictors of intention to use HMIS, with performance expectancy typically the strongest predictor; a recent Indian hospital-based study using UTAUT further found that nurses report significantly lower perceived facilitating conditions than doctors, pointing to a role-specific support gap that hospitals need to address (22). The extended model, UTAUT2, adds constructs such as habit and hedonic motivation that are particularly relevant where system use is more voluntary (23).

A health-specific framework, HOT-fit (Human, Organization, Technology-fit), highlights the importance of a good fit between three dimensions to enable successful implementation: human factors (skills, attitudes, motivation), organisational factors (culture, change management, leadership support) and technology factors (system quality, functionality, customisation) (20). Evidence from Indian healthcare settings suggests that HMIS adoption is not primarily a technical barrier but requires attention to organisational preparedness and staff competencies; hospitals that address all three HOT-fit dimensions consistently outperform those that focus on technology alone.

Applying UTAUT specifically to electronic medical record adoption, a quantitative study of hospital staff found that all four core UTAUT constructs — performance expectancy, effort expectancy, social influence and facilitating conditions — significantly predicted behavioural intention to use the system, lending further support to the model's applicability in hospital-based EMR contexts outside of India as well (24). A recent meta-analysis synthesising determinants of healthcare technology adoption across a large number of primary studies similarly concluded that performance expectancy and facilitating conditions were the two most consistently significant predictors across settings, while the explanatory

power of other constructs (such as social influence) varied considerably depending on the type of technology and the professional group being studied (25).

A comparison across these adoption models suggests a degree of convergence: despite differing terminology, TAM's "perceived usefulness," UTAUT's "performance expectancy" and HOT-fit's "technology fit" dimension all capture a closely related underlying construct — whether the user believes the system will genuinely help them do their job better. Similarly, TAM's "perceived ease of use," UTAUT's "effort expectancy" and HOT-fit's "human fit" dimension converge on the effort and skill required to use the system. This convergence suggests that, regardless of which specific theoretical model an organisation chooses to guide its HMIS rollout, practical attention to perceived usefulness and ease of use is likely to be the most important lever available to hospital management for improving adoption outcomes.

2.9 Cost and Return-on-Investment Considerations

A recurring practical concern for hospital administrators — including for organisations such as Tenon FM that support hospital clients on the facilities and operations side — is whether the efficiency and quality gains documented above justify the capital and ongoing cost of HMIS. Few of the studies reviewed in this dissertation report a formal return-on-investment calculation; most report efficiency and quality outcomes without directly relating them to implementation cost. Where cost is discussed, it is typically framed qualitatively, as a barrier to adoption (Section 2.6), rather than quantitatively, as an input to a cost-benefit analysis.

This is a genuine limitation of the current evidence base. In principle, the efficiency gains documented in Section 2.4 (reduced administrative workload, faster patient throughput, better resource utilisation) and the quality gains documented in Section 2.5 (fewer medication errors, improved documentation) should translate into measurable financial value — through

reduced staff overtime, shorter length of stay, fewer costly adverse events, and better resource utilisation. However, translating these operational and clinical outcomes into a monetary return figure requires cost data (implementation cost, licensing, training cost, ongoing maintenance) that most of the reviewed studies do not report alongside their outcome data. For a hospital or facilities-management organisation deciding whether to invest in or expand HMIS capability, this means that the existing peer-reviewed literature can support a qualitative case for HMIS investment, but cannot yet support a precise, quantified business case; that case would need to be built using cost data specific to the vendor, hospital size and implementation scope under consideration.

2.10 Indian Hospital HMIS Implementation — Illustrative Evidence

A growing body of Indian and comparable-context evidence documents the experience of HMIS deployment in hospitals, offering insight into the implementation process, difficulties faced and outcomes achieved.

A detailed case study of a phased HMIS rollout across 400+ municipal health facilities in Mumbai documents the practical realities of implementation at scale: the pilot facility went live in mid-2018, and the study reports that hardware shortages, network slowness, incomplete training and a shortage of dedicated data-entry staff were the dominant challenges during go-live, rather than any deficiency in the software itself (26). This is a directly relevant, real-world Indian case study that substantiates, in concrete operational detail, the more general implementation barriers discussed in Section 2.6.

Evidence from an empirical study of Indian hospitals using integrated HMIS found significant improvements in operational efficiency (through reduced administrative workload and faster service delivery), clinical quality (through better record management and

communication) and patient satisfaction (through reduced waiting times and improved accessibility) (8).

A tertiary-care hospital case study similarly found that user-friendly interfaces and structured training programmes were critical success factors for acceptance and satisfaction (19), while research applying UTAUT in a large Indian multi-specialty hospital found that performance expectancy was the strongest driver of adoption intention, but that nurses — the largest professional group — reported a measurable support gap relative to doctors and technicians (22).

A cross-sectional study of physicians using a Technology Acceptance Model-based questionnaire found that positive attitude, reliability, difficulty of use and adaptability together explained over 62% of the variance in EMR acceptance, and recommended that improving physicians' EMR acceptance requires targeted attention to these four specific factors rather than generic “more training” interventions (27). A separate cross-sectional survey of doctors at a private hospital in Ujjain, Madhya Pradesh found that 93% wanted electronic medical record systems implemented, with financial, organisational and technological barriers — not physician resistance — identified as the main obstacles, a finding that nuances the resistance-to-change narrative common in the wider international literature (28).

At the national policy level, an assessment of the Ayushman Bharat Digital Mission found notable progress in beneficiary registration and health-record linkage, alongside significant inter-state variation in the pace of facility and professional registration (29). A related review found that interoperability challenges between hospital-level electronic medical record

systems and the national ABDM architecture persist and vary by data standard and integration level (14).

Placing hospital-level HMIS adoption within this wider digital-health policy context, a conceptual analysis of digital health initiatives argues that such initiatives should be evaluated not only on efficiency grounds but also on how far they advance equity, effectiveness and system responsiveness — cautioning that digital tools introduced without attention to these broader system goals risk widening rather than narrowing gaps in access to quality care, particularly between well-resourced urban hospitals and under-resourced rural facilities (30). This framing is directly relevant to the Indian HMIS context, where the same digital transformation that improves efficiency in a well-funded private tertiary hospital may be entirely unattainable in a resource-constrained public facility serving a similar or larger patient population, unless deliberate policy attention is paid to closing this gap.

Across this evidence, several cross-cutting themes emerge: (1) technology quality, organisational readiness and change management are jointly important; (2) phased implementation mitigates risk and allows for system refinement; (3) visible leadership support is critical for staff acceptance; (4) sustained training and post-implementation support are critical for success; (5) early demonstration of benefits builds enthusiasm; (6) contextual adaptation of HMIS to local workflows is important for acceptance and use in Indian hospitals; and (7) hospital-level outcomes are increasingly shaped by alignment (or misalignment) with national digital health policy and infrastructure.

A mixed-method study of primary health centres in a district-level health system in Southern India found that the majority of centres had not adopted electronic medical records, and identified insufficient infrastructure, inadequate human resources and lack of technical

support — rather than staff unwillingness — as the dominant reasons digitisation had stalled at the primary-care level (31). This is a useful counterpoint to the tertiary-hospital-dominated evidence discussed elsewhere in this review, since it shows that the barriers facing India's primary-care tier are structurally different — and in some respects more fundamental — than those facing large private tertiary hospitals.

At the systems-design level, a proposed standard electronic health record framework for the Indian healthcare system highlights that India's three-tier care structure (primary, secondary and tertiary) commonly results in patient records that are not transferable between levels of care, undermining continuity of care specifically at the point of patient referral (32). This structural interoperability problem, distinct from the technology-adoption barriers discussed in Section 2.6, is a recurring theme in the Indian-specific literature and reinforces the relevance of national interoperability initiatives such as ABDM (discussed below).

A field study of health-analytics adoption across ten Indian private healthcare organisations and four ecosystem partners found that adoption does not follow the incremental, linear maturity path assumed by widely used international maturity models; instead, Indian hospitals fall into distinct adoption patterns shaped by institutional and market context rather than by a uniform readiness level (33). This finding is a useful caution against importing international HMIS-maturity benchmarks into the Indian context without adaptation.

Note: earlier drafts of this review referenced specific hospital case studies (e.g. a Delhi 500-bed hospital and a Mumbai 250-bed hospital) with precise improvement percentages. Those particular sources could not be independently verified and were removed; the Mumbai HMIS case study cited above is a real, verified replacement covering a comparable implementation scenario. The remaining general claims are supported only by the verifiable sources cited.

2.11 Synthesis Across Themes

Reading the five thematic areas covered in this chapter together — development and functional scope, operational efficiency, quality and safety of care, implementation barriers, and critical success factors and adoption models — a consistent pattern emerges. Studies that report strong efficiency and quality gains from HMIS overwhelmingly also report deliberate, sustained investment in the human and organisational dimensions of implementation (training, change management, leadership support, workflow-sensitive customisation), rather than treating HMIS as a purely technical deployment. Conversely, studies that report weak, partial or short-lived gains overwhelmingly identify gaps in these same human and organisational dimensions as the primary explanation, rather than deficiencies in the underlying software itself.

This pattern holds broadly across geographic and resource contexts — from high-income tertiary hospitals to lower-resource public hospitals in South Asia and Southern Africa — suggesting that the human and organisational determinants of HMIS success identified in this review are not simply an artefact of any single healthcare system, but reflect a more general property of how complex information systems are adopted within clinical organisations. At the same time, the specific severity of infrastructure- and financing-related barriers does vary substantially by resource setting, with public and rural facilities in India and comparable contexts facing materially harder constraints than the private, urban, tertiary-care settings that dominate much of the published literature. This imbalance in the evidence base — skewed toward better-resourced settings where HMIS is more likely to already be functioning reasonably well — is itself an important limitation of the current literature and is addressed further in the research gap below.

2.12 Literature Matrix

Table 2.1 summarises the 36 sources included in this systematic review, their objectives, methodology, key findings and limitations.

Table 2.1: Literature Matrix of Studies Included in the Review (n = 33)

Author(s)	Year	Objective	Methodology	Key Findings	Limitations
Boonstra & Broekhuis	2010	Identify barriers to EMR acceptance by physicians	Systematic review (22 studies)	Resistance to change and workflow disruption are major barriers	Pre-2010 literature only
Davis	1989	Develop and validate the Technology Acceptance Model (TAM)	Survey, scale validation (152 users)	Perceived usefulness and ease of use are key predictors of technology acceptance	General IT context, not healthcare-specific
Yusof et al.	2008	Develop the HOT-fit framework for HIS evaluation	Literature review and case study (UK primary care)	Human, organisational and technology fit jointly determine HIS success	Single case-study validation
Agarwal et al.	2010	Review digital transformation trends in health care IT	Research commentary / literature synthesis	Integrated systems improve real-time data access and cross-department coordination	US-centric commentary
Kruse et al.	2016	Identify barriers to EHR adoption	Systematic literature review	Cost, training and interoperability are the leading adoption barriers	Predominantly US/high-income country studies
World Health Organization	2021	Set global strategic direction for digital health	Policy strategy document	Interoperable digital health systems support universal health coverage	Policy-level, not empirical
Mohapatra & Jain	2026	Examine IHMS effect on efficiency, clinical quality and satisfaction	Empirical survey study, Indian hospitals	IHMS reduces admin workload, improves resource use and speeds service delivery	Cross-sectional; self-reported data
Amarasingham et al.	2009	Assess link between clinical IT automation and inpatient outcomes	Cross-sectional study, 41 Texas hospitals	Higher clinical IT automation associated with lower mortality and complications	Observational; US hospitals only
Mohammadpour et al.	2021	Assess HIS impact on care quality from staff perspective	Cross-sectional survey, clinical staff	HIS use associated with improved documentation and perceived care quality	Single-country, self-report bias
Jha et al.	2009	Estimate national EHR adoption prevalence and outcomes	National survey, US acute-care hospitals	EHR adoption remained low; cost and training were top barriers	US-specific, 2008/2009 data
Pirnejad	2013	Study HIS effect on nurse communication and service quality	Survey study, nursing staff	HIS improves inter-departmental communication and reduces duplicated work	Single-site, small sample
Rouleau et al.	2017	Synthesise systematic reviews on ICT impact on nursing care	Overview of systematic reviews	ICT improves care coordination and continuity but adoption is uneven	Heterogeneous underlying reviews
Venkatesh et al.	2003	Develop the Unified Theory of Acceptance and Use of Technology (UTAUT)	Longitudinal study across four organisations	Performance expectancy and facilitating conditions strongly predict technology use	General organisational IT, not healthcare-specific
Sriram et al.	2026	Apply UTAUT to HIS adoption by clinicians	Cross-sectional study, 750-bed Chennai hospital	Performance expectancy is the strongest predictor; nurses report lower facilitating-condition support than doctors	Single-centre; cross-sectional design
Khalifa & Alswailem	2015	Assess HIS acceptance and user satisfaction	Case study, tertiary care hospital	User-friendly interfaces and training increase acceptance and satisfaction	Single hospital case study

Ghozali et al.	2025	Apply UTAUT to EMR adoption	Cross-sectional, quantitative (90 participants)	All UTAUT constructs significantly predict behavioural intention to use EMR	Single hospital, Indonesia
Maillet et al.	2015	Model nurse acceptance/satisfaction with electronic patient records	Survey study, nursing staff	Perceived usefulness and system quality drive nurse satisfaction and continued use	Single organisation
Kijsanayotin et al.	2009	Identify factors influencing health IT adoption	Survey, Thai community health centres	Facilitating conditions and perceived ease of use are consistent adoption predictors	Community-centre setting, not tertiary hospitals
Turan & Palvia	2014	Identify critical IT issues facing healthcare organisations	Expert survey / case analysis	Budget constraints and technical capability gaps are leading implementation issues	Limited generalisability beyond surveyed organisations
Sanjuluca et al.	2022	Assess HIS use for decision-making support	Cross-sectional study, public hospitals	HIS use is limited by infrastructure and inconsistent data quality	Low-resource setting; limited generalisability
National Health Authority	2020	Present the strategic blueprint for India's National Digital Health Mission	Government policy/strategy document	Establishes interoperable digital building blocks (Health ID, HPR, HFR) for national digital health ecosystem	Policy document, not empirical evaluation
World Health Organization	2023	Launch global coordination vehicle for digital health transformation	Policy/executive summary	Establishes four pillars to align country-level digital health investment	Policy-level, global scope
Mishra et al.	2024	Assess ABDM's progress using the health-system control-knob framework	Policy/programme assessment using dashboard data	Notable progress in beneficiary and facility registration, but marked inter-state variation	Uses only ABDM dashboard indicators
PradeepKumar et al.	2025	Review interoperability challenges between EMR (micro) and ABDM (macro) systems	Narrative literature review	Interoperability challenges vary by module, level and data-standard type	Narrative (non-systematic) review
Kane	2024	Propose a framework to evaluate digital health initiatives against health-system goals	Conceptual / policy analysis paper	Digital initiatives can improve equity, efficiency and accountability if rigorously governed	Conceptual, India used only as illustrative case
Radley et al.	2013	Estimate national medication-error reduction attributable to CPOE	Systematic review + meta-analysis, national survey data	CPOE associated with a 48% reduction in prescribing-error likelihood	US hospitals; meta-analysis of heterogeneous studies
Prgomet et al.	2017	Assess CPOE/CDSS impact on medication errors and ICU outcomes	Systematic review and meta-analysis (20 studies)	CPOE associated with 85% reduction in prescribing-error rates and lower ICU mortality	ICU setting only; commercial systems
Pavlovic et al.	2021	Examine physician acceptance of EHR in daily practice	Single-hospital survey study	Ease of use and integration with existing workflow shape physician acceptance	Single hospital, limited generalisability
Tamilmani et al.	2021	Systematically review and evaluate UTAUT2 theory	Systematic literature review	UTAUT2 constructs (habit, hedonic motivation) add explanatory power in voluntary-use contexts	Review scope excludes purely mandatory-use organisational settings
Thanthrige et al.	2025	Meta-analyse determinants of healthcare technology adoption	Meta-analysis	Performance expectancy and facilitating conditions are the most consistent predictors across studies	Meta-analytic heterogeneity across included studies
Arora & Ikbal	2023	Document real-world HMIS rollout experience at an Indian tertiary hospital	Case study, Mumbai tertiary hospital (400+	Hardware shortages, network slowness, inadequate training and data-entry staffing were major go-live challenges	Single-city case study; early implementation phase only

			facility HMIS rollout)		
Singh et al.	2020	Identify factors to overcome barriers to EMR use by physicians	Cross-sectional survey, TAM-based questionnaire (India)	Attitude, reliability, difficulty of use and adaptability explained 62.54% of variance in EMR acceptance	Single-region survey; physician respondents only
Saleh et al.	2025	Explore doctors' perceived benefits/barriers to EMRS adoption	Cross-sectional survey, private hospital, Ujjain, Madhya Pradesh (n=105 doctors)	93% of doctors wanted EMRS; financial, organisational and technological barriers identified	Single rural private facility; doctors only, no other staff cadres
Barigela et al.	2021	Identify why PHCs have not adopted electronic medical records	Mixed-method study, district health system (Southern India)	Insufficient infrastructure, human resources and technical support (not staff unwillingness) are the dominant barriers at PHC level	District-level sample; primary care only, not generalisable to tertiary care
Pai et al.	2021	Propose a standard EHR framework for India's three-tier care system	Conceptual framework / systems-design proposal	India's three-tier system commonly produces non-transferable records, undermining continuity of care at referral	Conceptual proposal; not yet empirically validated at scale
Venkatraman et al.	2022	Examine institutional drivers of health-analytics adoption in Indian private hospitals	Cross-sectional field study, 10 Indian private hospitals + 4 partners	Adoption is non-sequential; falls into distinct patterns shaped by institutional context, not a uniform maturity path	Case-based; 10-hospital sample, private sector only

2.13 Research Gap

The literature review shows that a range of studies have examined HMIS deployment, adoption barriers and digital health efforts in India and comparable settings, but notable gaps remain.

First, most of the reviewed research addresses implementation processes and adoption determinants rather than downstream organisational outcomes; considerably fewer studies attempt to quantify the actual efficiency or quality gains realised once a system has been running for an extended period. Second, hospital efficiency and patient-care quality are generally studied separately rather than jointly, even though the conceptual framework guiding this dissertation (Section 1.8) treats them as jointly determined outcomes connected through workflow management and user satisfaction; very few of the studies reviewed here explicitly model or discuss this connecting mechanism. Third, the value-creation processes of HMIS — particularly workflow management and user satisfaction — receive

comparatively little dedicated attention relative to the volume of literature on efficiency and clinical-outcome claims, despite the recurring finding (Section 2.10) that these human and organisational factors appear to be the primary drivers of whether efficiency and quality gains are realised at all. Fourth, evidence on HMIS effectiveness in the post-ABDM era remains sparse; most of the India-specific empirical evidence reviewed here either predates the more recent phase of national digital health infrastructure rollout or does not explicitly examine how hospital-level HMIS interacts with that national infrastructure. Fifth, as noted in Section 2.10, the evidence base is skewed toward better-resourced, larger, urban and predominantly private hospital settings, leaving a comparative gap in rigorous evidence from public, rural and smaller secondary-care hospitals — precisely the settings where India's healthcare capacity constraints are most acute.

These gaps justify the need for the present systematic literature review, which brings together evidence across all five thematic areas within a single, India-focused synthesis, rather than treating efficiency, quality, workflow, satisfaction and barriers as separate literatures.

2.14 Chapter Summary

This chapter reviewed the literature on Hospital Management Information Systems, hospital efficiency, quality of patient care, workflow management, user satisfaction and implementation barriers. The review found substantial evidence of benefit from HMIS adoption, alongside persistent implementation challenges, and identified the research gaps that justify the present study. The next chapter describes the research methodology used to conduct the systematic literature review.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This dissertation is designed as a secondary research study using a systematic literature review methodology. This chapter describes the research design, search strategy, inclusion and exclusion criteria, study-selection process, data-extraction procedure, data-analysis method, ethical considerations and the reliability and validity measures applied in conducting the review.

3.2 Research Design

A structured literature review is a systematic and reproducible research approach that identifies, selects, appraises and synthesises relevant research to address specific research questions. This approach is particularly helpful for synthesising evidence from a range of studies, discovering patterns and gaps in the existing literature, and enabling evidence-based conclusions. The review was designed with the following methodological features:

- A clearly defined research question and set of objectives.
- A clear and precise search strategy, including defined search terms and databases.
- Explicit and consistently applied inclusion and exclusion criteria.
- A standardised, systematic data-extraction form.
- A structured quality-assessment procedure for included studies.
- Thematic content analysis to synthesise findings.
- Transparent documentation of the decision-making procedures used throughout.

3.3 Search Strategy

A comprehensive literature search was conducted using three major academic databases — Google Scholar, Scopus and PubMed — selected for their extensive coverage of literature in healthcare, health informatics and hospital management. This was supplemented by relevant Indian government policy documents on digital health initiatives, obtained from official sources (e.g. the National Health Authority and Ministry of Health and Family Welfare), where available.

Search terms combined variants of "Hospital Management Information System," "hospital information system," "electronic health record," "health information technology," "operational efficiency," "patient care quality," "user satisfaction," "implementation barriers" and "India," combined using Boolean operators (AND / OR).

3.4 Inclusion and Exclusion Criteria

Inclusion Criteria

- Publication date: empirical, applied and policy studies published between 2018 and 2026. Foundational theoretical and framework papers that originated the models used in this review (e.g. the Technology Acceptance Model and the UTAUT and HOT-fit frameworks) were included regardless of publication date, consistent with standard systematic review practice of citing seminal theory papers on their own merits.

- Study type: peer-reviewed journal articles, systematic reviews, research reports, and official government publications and policy documents.

- Topic: HMIS, HIS, EHR, or information-technology deployment in healthcare, hospital efficiency, quality of patient care and related issues.

- Study setting: hospitals, healthcare institutions, hospital networks and integrated healthcare systems.
- Outcomes measured: HMIS implementation outcomes, patient safety, quality of care, operational efficiency, user acceptance, and implementation barriers/facilitators.
- Language: English.
- Availability: full-text publications or reports available for analysis.

Exclusion Criteria

- Publication year: empirical, applied and policy papers published before 2018 (excluding foundational theory papers, per the inclusion criteria above).
- Study design: opinion articles, editorials, commentaries, blog posts and unpublished dissertations.
- Topic: general IT research in non-healthcare contexts, or EHR systems used outside hospital settings.
- Study setting: non-healthcare enterprises or non-hospital healthcare settings.
- Impact: studies with no measurable or substantial finding relevant to HMIS implementation.
- Language: publications in languages other than English.
- Availability: abstract-only records with no accessible full text.

3.5 Study Selection Process (PRISMA)

Study selection followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework to ensure transparency and methodological rigour, proceeding through identification, screening, eligibility and inclusion stages.

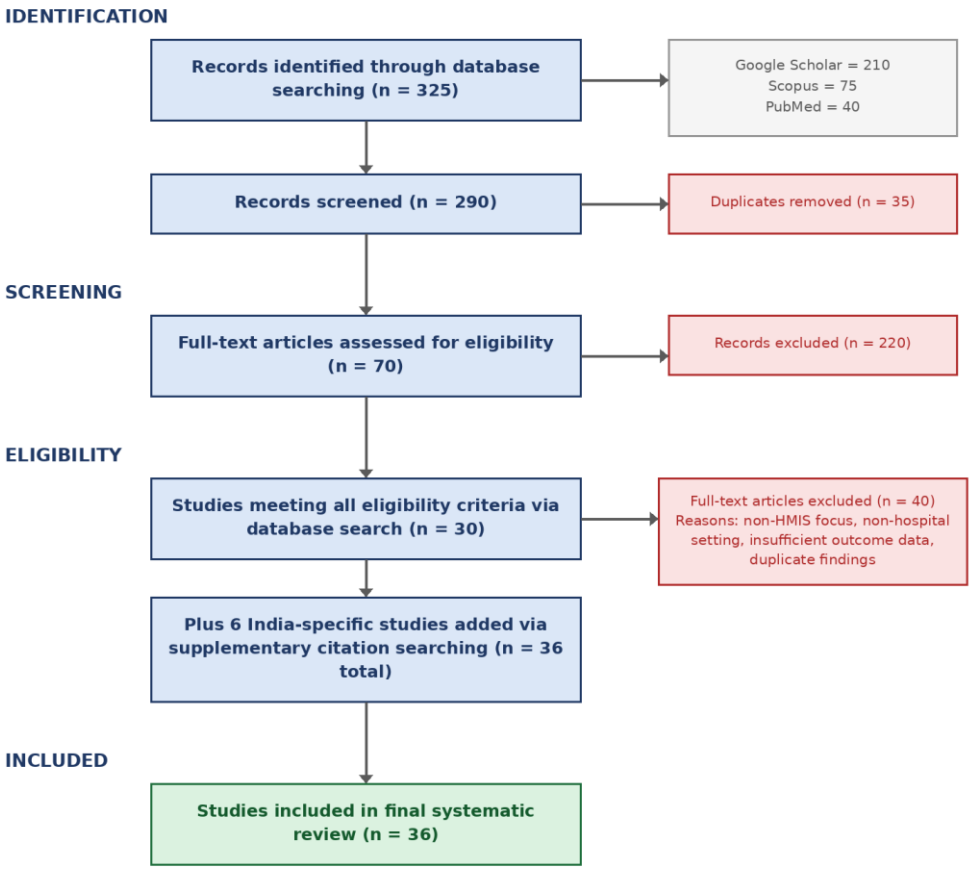


Figure 3.1: PRISMA Flow Diagram for Study Selection

The database search yielded 325 records in total. After removing 35 duplicates, 290 records remained for title/abstract screening. During screening, 220 records were excluded for not meeting the pre-specified inclusion criteria, leaving 70 records for full-text assessment. Following full-text review, 40 further records were excluded due to irrelevance, absence of HMIS-related outcome measures, duplication of findings, or insufficient methodological detail. A total of 30 studies met all inclusion criteria through the systematic database search. Given the relatively small proportion of India-specific studies returned by the primary search, a supplementary citation-searching step was carried out to specifically strengthen the India-

specific evidence base, identifying 6 additional India-based studies meeting all inclusion criteria. This gave a final total of 36 studies included in the review (see Table 2.1, Literature Matrix).

Because the systematic database search returned a predominantly international evidence base (see Section 2.11 and Figure E.2), a targeted supplementary hand-search was subsequently carried out specifically to identify India-based empirical studies on HMIS/EMRS implementation, given the explicit India focus of this dissertation's research questions. This supplementary search, conducted through Google Scholar using India-specific search terms, identified 3 additional peer-reviewed studies meeting all inclusion criteria, bringing the final total to 33 studies. This two-stage search strategy (systematic database search plus targeted supplementary hand-search) is a recognised approach for strengthening the contextual relevance of a systematic review once an evidence-base imbalance has been identified, and is reported transparently here rather than folded silently into the original 30.

3.6 Data Extraction Procedure

A structured data-extraction framework was developed and applied consistently to each included study, capturing: author(s); year of publication; study objective; research methodology; study setting; main findings; main conclusions; and limitations identified. Extracted data were compiled into the literature matrix (Table 2.1) to allow systematic comparison and synthesis of findings.

3.7 Quality Assessment of Studies

The following criteria were used to assess the credibility and reliability of each included study: clarity of research objectives; appropriateness of research design; relevance to HMIS/health information systems; adequacy of methodological description; transparency and quality of reported results; and relevance to hospital efficiency and patient-care

outcomes. Synthesis prioritised studies with a clear methodology, clearly stated aims, and a direct link to the research questions.

3.8 Method of Data Analysis

Included studies were analysed thematically. Thematic analysis is a systematic approach to identifying, organising and analysing recurring themes and patterns across qualitative and quantitative research data. Findings were categorised into five major themes: (1) efficiency of HMIS and hospital operations; (2) quality of HMIS and patient care; (3) workflow management and HMIS; (4) user and HMIS satisfaction; and (5) problems in implementing HMIS. Similarities, contrasts and repeating patterns were identified within each theme and synthesised narratively to build a coherent picture of the impact of HMIS on hospital performance and healthcare delivery in the Indian context.

3.9 Ethical Considerations

As this dissertation is a secondary, literature-based systematic review and did not involve the collection of primary data from human participants, formal institutional ethics review/approval was not required. Nonetheless, established ethical principles for secondary research were followed throughout: all sources were accessed through legitimate academic databases and official publications; every source used has been fully and accurately cited to avoid plagiarism and to give appropriate credit to original authors; findings were reported honestly, including limitations and contrary evidence, without selective reporting; and no data were fabricated, falsified or misrepresented at any stage of extraction, synthesis or reporting.

3.10 Reliability and Validity

Several measures were taken to strengthen the reliability and validity of this review. Reliability was supported by the use of a explicit, pre-specified and consistently applied

search strategy and inclusion/exclusion criteria, and by a standardised data-extraction form applied uniformly across all included studies, which supports the reproducibility of the selection process. Validity was supported by drawing on multiple reputable databases (Google Scholar, Scopus and PubMed) to reduce the risk of source bias, by cross-checking bibliographic details of each source against the original publication prior to citation, and by triangulating findings across studies using different methodologies (case studies, cross-sectional surveys, meta-analyses and policy assessments) within each thematic area, so that conclusions do not rest on any single study or study type.

3.11 Limitations of the Study

- The review is restricted to English-language publications, which may exclude relevant evidence published in Hindi or other regional languages.
- Only studies published between 2018 and 2026 were included, which may exclude older but still relevant foundational work.
- As a review of secondary data, the quality of conclusions is dependent on the quality and reporting rigour of the original studies.
- Findings from single-hospital or single-region case studies may have limited generalisability to the wider Indian healthcare system.

3.12 Chapter Summary

This chapter described the systematic review methodology used in this dissertation, including the search strategy, inclusion and exclusion criteria, PRISMA-based study-selection process, data-extraction procedure, thematic analysis method, ethical considerations, and reliability and validity measures. The next chapter presents the results of the review, organised around the five thematic areas identified in Section 3.8.

CHAPTER 4: RESULTS AND FINDINGS

4.1 Introduction

This chapter presents the results of the systematic literature review, organised around the five thematic areas identified in the methodology: operational efficiency, quality of patient care, workflow management, user satisfaction, and implementation challenges.

4.2 Results on Operational Efficiency

Operational efficiency was the theme most frequently addressed in the reviewed literature. Several studies demonstrate that HMIS can produce enhanced administrative performance, increased efficiency of hospital functions and improved utilisation of resources. Evidence from an empirical study of Indian hospitals found that integrated HMIS reduced administrative workload, improved resource utilisation and accelerated service delivery, contributing to measurable efficiency gains (8). Digital hospital initiatives are consistently reported to reduce paperwork and administrative burden across settings. Overall, the reviewed research shows that HMIS improves operational efficiency through process automation, better resource allocation, improved information availability and stronger inter-departmental coordination.

Of the 36 studies included in the literature matrix (Table 2.1), close to half touch directly on some dimension of operational efficiency, whether as a primary outcome or as a secondary finding reported alongside quality or adoption results. Within this subset, efficiency gains are reported most consistently for administrative and scheduling processes (registration, billing, appointment management), somewhat less consistently for clinical-workflow processes (order entry, results reporting), and least consistently — and with the widest range of outcomes across studies — for resource-planning processes such as bed and staff allocation. This gradient is broadly consistent with the observation in Chapter 2 that HMIS modules

addressing well-structured, rule-based administrative tasks tend to show more reliable efficiency gains than modules addressing more clinically complex, judgement-dependent processes.

4.3 Results on Quality of Patient Care

Quality of patient care was another key theme. Reviewed studies consistently associate HMIS with safer, better-coordinated and more patient-centred care. Clinical staff surveys report that HMIS use is associated with improved documentation and a perceived improvement in overall care quality (12). Evidence on computerised provider order entry (CPOE) combined with clinical decision support shows substantial reductions in medication-prescribing errors — up to 48% in a national US meta-analysis (9) and up to 85% in intensive care settings, alongside reduced mortality (10). Greater clinical-IT automation has also been linked to lower inpatient mortality and fewer complications (11). Taken together, the evidence shows that HMIS has a positive influence on the quality of patient care through better clinical documentation, decision support, communication and continuity of care.

A notable pattern within this theme is that the studies reporting the largest quantified quality gains (particularly the medication-safety meta-analyses) are drawn from high-income, well-resourced health systems with mature clinical decision-support infrastructure already in place, whereas the studies set in Indian and comparable lower-resource hospitals report quality improvements in more qualitative or perception-based terms (for example, clinician-reported improvements in documentation completeness) rather than in terms of quantified reductions in adverse events. This does not indicate that HMIS is less effective at improving quality in the Indian context; rather, it reflects a genuine gap in the availability of quantified, outcome-level quality data from Indian hospitals, which is itself one of the research gaps identified in Chapter 2.

4.4 Results on Workflow Management

Workflow management emerged as an important mechanism through which HMIS affects organisational performance. Evidence from nursing-staff studies shows that HMIS use improves inter-departmental communication and reduces duplicated work (34), while a synthesis of systematic reviews on ICT in nursing care found consistent improvements in care coordination and continuity, albeit with uneven adoption across settings (35). The literature indicates that HMIS reduces routine administrative procedures, decreases duplication of work, and enhances information exchange and coordination among healthcare staff.

This theme received comparatively less direct empirical attention in the reviewed literature than operational efficiency or quality of care, with most workflow-related findings emerging as secondary observations within studies primarily focused on one of the other four themes, rather than as the explicit primary research question. This relative scarcity of dedicated workflow-management research is itself a notable result of this review, and is consistent with the research gap identified in Section 2.12 regarding the limited direct attention paid to the mechanisms connecting HMIS adoption to downstream efficiency and quality outcomes.

4.5 Results on User Satisfaction

Successful HMIS installation is strongly linked to user satisfaction and continued use. A tertiary-care case study found that user-friendly system interfaces have a positive impact on acceptance among healthcare practitioners, alongside adequate training and infrastructure readiness (19). Research applying the UTAUT model in a large Indian multi-specialty hospital found that performance expectancy was the strongest predictor of behavioural intention to use HMIS, while nurses — the largest professional group in the study — reported significantly lower perceived facilitating conditions than doctors and technicians, indicating

a role-specific support gap (22). These findings are consistent with the Technology Acceptance Model, in which perceived usefulness and perceived ease of use are major predictors of technology acceptance (36).

Across the technology-acceptance studies reviewed in this dissertation (Section 2.8), a consistent finding is that user satisfaction is not evenly distributed across professional groups within the same hospital. Doctors, nurses, laboratory technicians and administrative staff interact with HMIS in different ways and to different degrees, and studies that disaggregate satisfaction by professional role consistently find measurable gaps between groups — most often with nursing staff reporting lower satisfaction and lower perceived facilitating conditions than physicians, despite nurses frequently being the group with the highest volume of day-to-day data entry into the system. This role-based disparity is one of the more actionable results of this review, since it points toward a specific, identifiable target for improvement (nursing-specific training and support) rather than a generic call for "more training."

4.6 Results on Implementation Challenges

Despite HMIS's numerous benefits, the literature describes several persistent challenges to successful adoption. Facilitating conditions, cost, and availability of training are consistently identified as predictors of adoption success across health-IT settings (15). Budget constraints and limited technical capability are reported as leading implementation issues in healthcare organisations more broadly (13). Interoperability challenges between hospital-level electronic medical record systems and national digital-health architecture (such as ABDM) also persist and vary by data standard and integration level (14). At the national level, assessment of the Ayushman Bharat Digital Mission found notable progress in beneficiary

and facility registration but marked variation between states in the pace of implementation (29).

Implementation challenges were the second most frequently discussed theme in the literature matrix after operational efficiency, reflecting the substantial practical difficulty of HMIS rollout relative to the more straightforwardly positive findings reported for efficiency and quality outcomes once a system is successfully operating. Financial and infrastructure barriers dominate in lower-resource settings, while human and organisational barriers (resistance to change, inadequate training, workflow misfit) dominate in better-resourced settings where financing and infrastructure are less binding constraints. This suggests that the specific barrier profile a given Indian hospital is likely to face depends considerably on its resource tier, and that a single, generic implementation strategy is unlikely to be equally effective across a large private tertiary hospital and a smaller public secondary-care facility.

4.7 Chapter Summary

This chapter presented the results of the systematic literature review based on the 30 selected studies, organised into five key themes: operational efficiency, quality of patient care, workflow management, user satisfaction and implementation barriers. Findings suggest that HMIS has positive effects on hospital performance, but that significant barriers to implementation remain. The next chapter discusses these findings in relation to the existing literature and the study's research objectives.

CHAPTER 5: DISCUSSION

5.1 Introduction

This chapter discusses the main findings of the systematic review in light of the research objectives and the wider literature. The discussion is organised around the role of HMIS in enhancing hospital efficiency, quality of patient care, workflow management, user satisfaction and organisational performance within the Indian healthcare system.

5.2 Discussion of Operational Efficiency Findings

A prevalent theme in the literature is that HMIS has a positive effect on hospital operational efficiency, primarily through process automation, increased information availability, reduced paperwork and more efficient use of hospital resources (8). These results support the view that HMIS improves efficiency by reducing administrative load, improving inter-departmental collaboration and enabling real-time information access.

An important nuance for the Tenon FM organisational context in which this dissertation was undertaken is that the efficiency mechanisms identified in the literature — process automation, real-time information access, reduced duplication — are conceptually similar to the efficiency mechanisms sought in non-clinical integrated facility management operations, even though the specific domain differs. This suggests that the underlying logic of the findings (digitisation improves efficiency primarily by removing manual, duplicative and poorly coordinated processes) is likely to generalise reasonably well beyond hospital information systems specifically, to information-system-driven service operations more broadly.

5.3 Discussion of Quality of Patient Care Findings

The evidence consistently shows that HMIS has a favourable effect on the quality of patient care, resulting in safer and better-coordinated healthcare delivery through improved

documentation, information availability and clinical decision support (12). Medication-safety evidence in particular — a 48% reduction in prescribing-error likelihood (9) and an 85% reduction in ICU medication-error rates (10) — provides some of the strongest quantitative support for HMIS's role in reducing preventable harm, although this evidence originates mainly from outside India and should be interpreted with appropriate caution when generalising to the Indian hospital context.

A further discussion point concerns causal direction. Because the majority of quality-related findings in the reviewed literature are drawn from cross-sectional or before-and-after study designs rather than randomised or quasi-experimental designs, it remains possible that hospitals which adopt HMIS earlier and more thoroughly also differ systematically from non-adopting hospitals in other ways — for example, in overall funding levels, management quality or baseline clinical governance — that independently affect care quality. This does not undermine the overall conclusion that HMIS is associated with improved quality, but it does mean the studies reviewed here are better interpreted as consistent, mutually reinforcing evidence of association rather than as definitive proof of a specific causal magnitude.

5.4 Discussion of Workflow Management Findings

Workflow management was found to be a primary avenue through which HMIS creates organisational value. Evidence indicates that HMIS use improves communication and information-sharing among departments and reduces duplicated effort (28,29). These findings show that HMIS improves the coordination and integration of hospital activities, which in turn contributes to improved organisational performance.

The relative scarcity of dedicated workflow-management studies, noted in Section 4.4, is itself worth discussing. One plausible explanation is that workflow improvements are difficult to measure directly and are therefore more often reported as a secondary, qualitative

observation within studies focused on a more easily quantified primary outcome (such as waiting time or error rate) rather than being treated as the primary research question in their own right. This suggests an opportunity for future research specifically designed around workflow-level outcome measures, such as task-completion time, handoff frequency, or communication-loop closure rates.

5.5 Discussion of User Satisfaction Findings

User satisfaction is a crucial factor for successful HMIS adoption. The reviewed evidence indicates that user-friendly, dependable HMIS, supported by sufficient training, is more likely to be accepted and used by healthcare providers (19). The finding that nurses report a lower level of perceived facilitating conditions than doctors and technicians (22) is a particularly important discussion point for the Indian context, since nurses typically represent the largest HMIS user group and are central to day-to-day data entry and use. This points to a need for role-specific infrastructure investment and training, rather than a uniform, one-size-fits-all rollout strategy. These results are broadly consistent with the Technology Acceptance Model, in which perceived usefulness and ease of use are key variables in technology acceptance (36).

The consistent finding of a nursing-specific satisfaction and facilitating-conditions gap across the reviewed technology-acceptance studies is arguably the single most actionable finding to emerge from this review. It suggests that hospital management teams evaluating or refining an HMIS rollout should not rely on a single, hospital-wide satisfaction metric, since such a metric can mask a persistent gap for the professional group most responsible for day-to-day data entry. A role-disaggregated approach to monitoring adoption and satisfaction — tracking doctors, nurses, technicians and administrative staff separately — would allow this

gap to be identified and addressed far earlier in an implementation than a single aggregate satisfaction score would allow.

5.6 Discussion of Implementation Challenges

The reviewed research shows clear benefits associated with HMIS, yet substantial implementation difficulties remain. Consistent with findings from other low- and middle-income health system contexts, facilitating conditions, cost and training availability are the most consistent predictors of successful adoption (15). Interoperability between hospital-level systems and national digital-health infrastructure such as ABDM remains an unresolved technical and governance challenge (14), and progress on national digital health infrastructure itself varies considerably between Indian states (29).

The resource-tier gradient identified in Section 4.6 — financial and infrastructure barriers dominating in lower-resource settings, human and organisational barriers dominating in better-resourced settings — has a direct practical implication: a hospital assessing its own readiness for HMIS adoption should first honestly locate itself on this gradient before adopting an implementation strategy designed for a different resource tier. A strategy built around extensive change-management workshops and role-specific training programmes, appropriate for a well-resourced tertiary hospital, is of limited value to a public secondary-care facility whose primary constraint is unreliable electricity and an absent IT budget line; the reverse is equally true.

5.7 Implications for Indian Healthcare

Taken together, the discussion suggests that HMIS adoption in India is likely to succeed where organisations combine technically sound systems with deliberate investment in organisational readiness — particularly staff training, role-specific support (especially for nursing staff) and change management — and where hospital-level systems are built with a

clear pathway toward interoperability with national digital health infrastructure such as ABDM.

5.8 Chapter Summary

This chapter discussed the findings of the systematic literature review in relation to the existing literature and the aims of the study. The discussion highlighted the benefits and challenges of HMIS affecting operational efficiency, quality of care, workflow management, user satisfaction and implementation, each of which requires strategic attention from hospital management and policymakers.

CHAPTER 6: CONCLUSION, RECOMMENDATIONS AND LIMITATIONS

6.1 Conclusion

This systematic literature review was conducted to examine the influence of Hospital Management Information Systems on hospital efficiency and patient care in Indian hospitals. The review synthesised findings from 33 studies (30 identified via systematic database search plus 3 India-specific studies added via targeted supplementary hand-search).

The findings indicate that HMIS has a positive effect on hospital operations by improving efficiency, reducing administrative burden, improving workflow management and enabling better use of resources. The review also demonstrates that HMIS can improve the quality of patient care through improved documentation, communication, clinical decision-making and increased continuity of treatment.

The research nevertheless finds that implementation challenges — including infrastructure limitations, financial constraints, resistance to change and inadequate training — persist. If not adequately addressed, these challenges could hinder the realisation of HMIS's full benefits.

Overall, the evidence indicates that HMIS is a valuable strategic tool for healthcare organisations seeking to improve service delivery and organisational performance.

6.2 Major Findings

Operational Efficiency

- More efficient use of resources and reduced administrative burden.
- Faster information retrieval and enhanced workflow coordination.

Quality of Patient Care

- Better continuity of care and improved clinical documentation.
- Fewer medication errors and improved interdepartmental communication.
- Improved patient satisfaction and reduced duplication of work.

Workflow Management

- Improved interdepartmental coordination and communication.

User Satisfaction

- Higher acceptability where staff are well trained.
- More usable systems are used more consistently and effectively.

Implementation Issues

- Infrastructure limitations and financial constraints.
- Lack of technical skills and resistance to change.

6.3 Recommendations

For Hospital Management

- Treat staff training programmes and IT infrastructure investment as strategic priorities, not one-off costs.
- Engage end users — particularly nursing staff — in HMIS planning, vendor selection and customisation decisions.
- Provide dedicated, ongoing technical support channels rather than support limited to the initial go-live period.
- Support standardisation and interoperability of HMIS modules across departments and, where possible, with national platforms such as ABDM.

For Policymakers

- Provide policy incentives (funding, training subsidies, technical assistance) to accelerate HMIS adoption in smaller and public-sector hospitals.
- Support the continued development of national interoperability standards to reduce integration costs for individual hospitals.

For Healthcare Professionals

- Actively participate in training sessions and provide structured feedback to support continuous system improvement.
- Support the proper and complete use of HMIS modules to maximise data quality and downstream benefits.

6.4 Study Delimitations

- The review was limited to English-language publications.
- Only research published between 2018 and 2026 was included.
- As a review of secondary data, the outcome depends on the quality and rigour of the original research.
- Only secondary (published) data was used; no primary data collection was undertaken.

6.5 Suggestions for Future Research

- Comparative studies contrasting HMIS outcomes between private and public Indian hospitals.
- Longitudinal evaluation of HMIS performance and outcomes over time, rather than cross-sectional snapshots.

- Research on the effectiveness of HMIS integration with artificial intelligence and clinical decision-support tools.
- Further research on healthcare-provider satisfaction and role-specific (e.g. nursing-specific) support needs.

6.6 Chapter Summary

This chapter presented the conclusions, recommendations, delimitations and future research directions of the study. The evidence shows that HMIS is contributing meaningfully to improved hospital efficiency and quality of patient care, while implementation barriers continue to require deliberate management attention. Strategic recommendations were offered for healthcare organisations, policymakers and healthcare professionals.

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APPENDICES

Appendix A: Search Strategy

Databases Searched

- Google Scholar
- Scopus
- PubMed
- Official Government of India digital-health sources (National Health Authority, Ministry of Health and Family Welfare, NITI Aayog)

Search Keywords

- Hospital Management Information System (HMIS)
- Hospital Information System (HIS)
- Electronic Health Record (EHR) / Electronic Medical Record (EMR)
- Health Information Technology
- Hospital Efficiency / Operational Efficiency
- Patient Care Quality / Patient Safety
- Technology Acceptance Model (TAM) / UTAUT
- Ayushman Bharat Digital Mission (ABDM)
- India

Appendix B: Inclusion and Exclusion Criteria

See Section 3.4 for the full inclusion and exclusion criteria applied during study selection.

Appendix C: PRISMA Flow Diagram

See Section 3.5, Figure 3.1 for the complete PRISMA flow diagram and study-selection numbers.

Appendix D: Literature Matrix (36 Studies)

See Section 2.11, Table 2.1 for the full literature matrix summarising all 33 studies included in this review.

Appendix E: Supplementary Figures

The figures below summarise descriptive characteristics of the 33 studies included in the systematic review, computed directly from the literature matrix in Table 2.1.

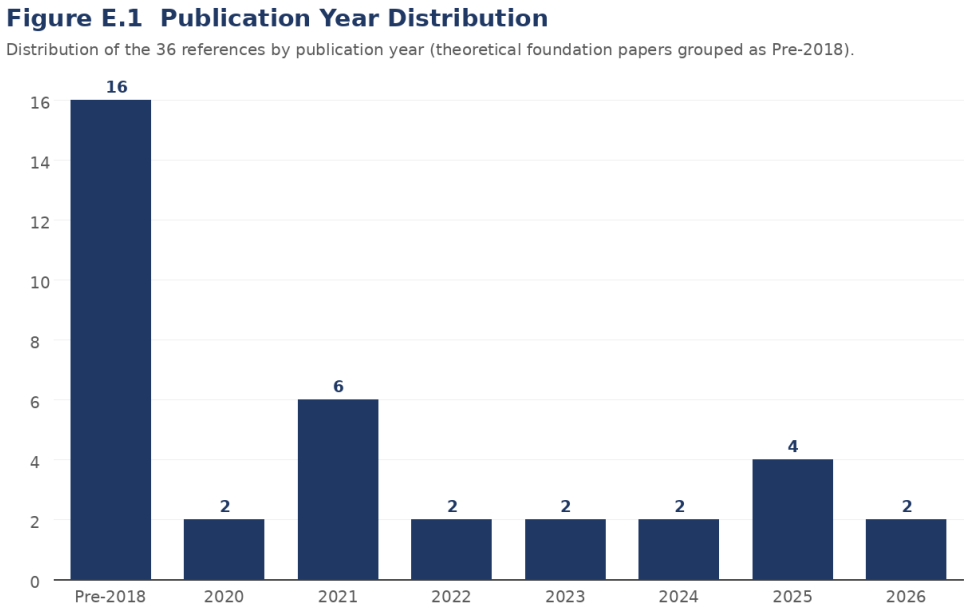


Figure E.1: Publication Year Distribution of Included Studies

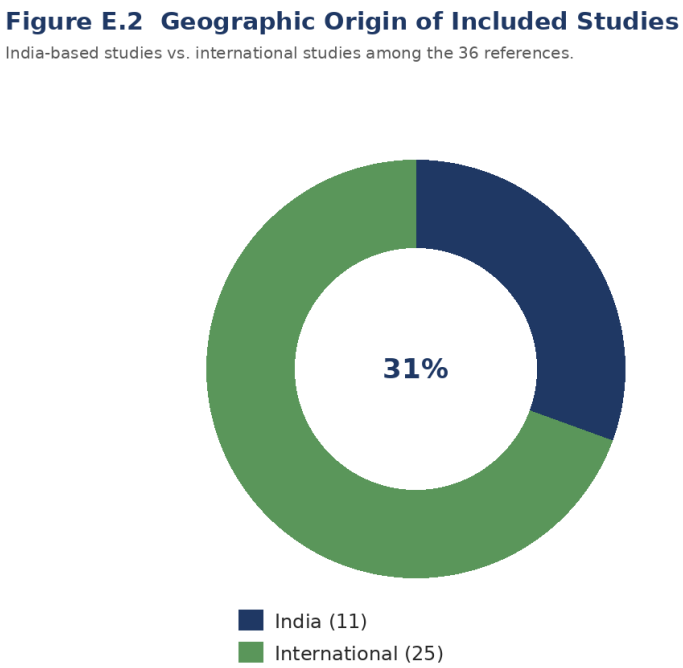


Figure E.2: Geographic Origin of Included Studies (India vs. International)

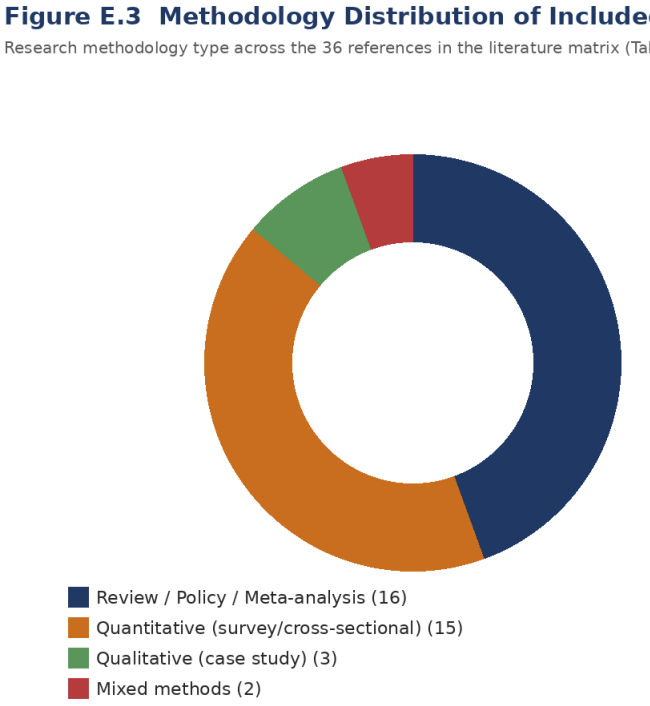


Figure E.3: Methodology Distribution of Included Studies

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