

# Challenges Encountered During the Transition to a Paperless Hospital System and Their Impact on Quality Indicators: A Prospective Observational Study

Kruti Gupta<sup>1</sup>, Medha Wadhwa<sup>2\*</sup>, Apurvakumar Pandya<sup>3</sup>, Hiral Patel<sup>4</sup>

<sup>1</sup>Research Associate, Centre for Quality Improvement and Patient Safety,  
Indian Institute of Public Health Gandhinagar, Gujarat, India.

<sup>2</sup>Assistant Professor & Lead, Centre for Quality Improvement and Patient Safety,  
Indian Institute of Public Health Gandhinagar, Gujarat, India.

<sup>3</sup>Assistant Professor & Co-lead, Centre for Quality Improvement and Patient Safety,  
Indian Institute of Public Health Gandhinagar, Gujarat, India.

<sup>4</sup>Quality and Medical Admin, VIMS Hospital Motera, Ahmedabad, Gujarat, India.

Corresponding Author: Dr. Medha Wadhwa

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## ABSTRACT

**Background:** The adoption of digital health technologies in hospitals, particularly the transition to paperless systems, is becoming increasingly important for improving healthcare efficiency, patient safety and quality of care. However, transitioning from traditional paper-based process to digital system poses multifaceted Challenges. This study explores these challenges experienced by a tertiary care hospital in Ahmedabad, during the implementation of the PRESCO (Paper Record System for Clinical Operations) System and assess its impact on selected quality and patient safety indicators.

**Methods:** A Prospective observational study was conducted for five consecutive months from January to May 2025 at a tertiary care Hospital, Ahmedabad. A total of 1,836 patient records and incident reports were analysed using structured surveys, direct observation, semi-structured interviews, and secondary document review. Quality indicators were also tracked monthly against NABH benchmarks.

**Results:** Eight core challenges were identified including limited digital literacy, staff resistance to change, infrastructure constraints, data migration difficulties and inadequate feedback mechanism. Targeted interventions such as staff training, system modifications, and infrastructure strengthening were implemented to address these barriers. Medication error rates, patient fall rates and radiology reporting errors reduced substantially during the study period, which shows a reduction in medication error rate from 6.62% to 0.10%; patient fall rate decreased from 5.67 to 0 per 1000 patient-days; radiology reporting error rate reduced from 22.1 to 0 per 1000 investigations.

**Conclusion:** Transitioning to a paperless hospital system involves significant implementation challenges. Despite these challenges it resulted in substantial improvements in patient safety and quality of care.

**Keywords:** Paperless hospital, Digital health transition, PRESCO system, Hospital

management system; Quality indicators, Patient safety.

## 1. INTRODUCTION

The healthcare sector is undergoing rapid digital transformation, with paperless or electronic health record (EHR) increasingly recognized as essential tools for improving healthcare quality, patient safety, and operational efficiency. The World Health Organization (WHO) has emphasized the importance of digital health technologies in achieving Universal Health Coverage (UHC) and the sustainable Development Goals through its Global Strategy on Digital Health 2020-2025 [1]. Across the world, hospitals that have transitioned from paper-based to fully electronic systems have reported significant improvements in documentation accuracy, interdepartmental communication and clinical decision-making processes [2].

Despite these benefits, the implementation of digital health systems remains challenging, particularly in low- and middle-income countries (LMICs). Many healthcare organizations struggle with inadequate infrastructure, limited technical expertise, resistance to change, and difficulties in integrating new systems into existing workflows. Studies from Sub-Saharan Africa, South and Southeast Asia have shown that poorly planned digital transitions can lead to low system utilization, data integrity failures, and dissatisfaction among healthcare workers. [3]. Even the high-income countries such as United States, hospitals have faced challenges related to inter operational increased workload, and adaptation to new digital processes. [4].

In India, digital health adoption has gained significant momentum through initiatives such as Ayushman Bharat Digital Mission (ABDM), which aims to establish an integrated health records ecosystem across both public and private sectors [5]. The National Digital Health Blueprint (NDHB) further promotes the hospital information management systems, emphasizing the

digitization of outpatient, inpatient, pharmacy, laboratory, and radiology workflows [6]. However, the extent of implementation remains uneven. Previous studies have identified persistent challenges including inadequate IT infrastructure, limited digital literacy among clinical staff, resistance to organizational change, and poor data migration processes [7].

Gujarat has emerged, as one of India's leading states in advancing healthcare quality and digital innovation. Initiatives such as NABH (National Accreditation Board for Hospitals & Healthcare Providers) and PMJAY (Pradhan Mantri Jan Arogya Yojana) have encouraged hospitals to strengthen their quality standards and adopt digital health technologies. In Ahmedabad, several private hospitals have taken a proactive approach by developing and implementing customized hospital management software (HMS) platforms to support digital healthcare delivery [8].

The success of digital transformation in healthcare largely depends on the staff perception and adaptability to the new technologies. A multicentric study conducted across Indian tertiary hospitals demonstrated that younger healthcare workers and IT-literate personnel generally show positive attitudes toward EHR adoption. In contrast, a previous study reported positive public perceptions of EHRs but limited awareness and uptake of Digital Health IDs. [9] The Technology Acceptance Model (TAM) has frequently been used to understand these attitudes, highlighting perceived usefulness and ease of use as the most important factors influencing acceptance of digital system [10].

The impact of digital health system on patient safety has also been widely documented. Evidence from the United Kingdom and Australia demonstrates that well planned EHR implementation can reduced medication dispensing errors, improved surgical safety checklists compliance, and enhanced infection control monitoring [11].

## **2. MATERIALS & METHODS**

### **2.1 Study Design and Setting**

The study was a Prospective observational study conducted at a tertiary care 201-bed multi-specialty hospital in Ahmedabad that commenced operations on 26 August 2024 and operates as a fully paperless facility using the PRESCO hospital management system. The hospital is in the process of obtaining accreditation from NABH, PMJAY, and the Quality Council of India (QCI).

### **2.2 Study Period and Sample Size**

The study was conducted over five consecutive months, from January to May 2025. A total of 1,836 patient records and incident reports were reviewed across multiple clinical and administrative departments, including the ICU, High Dependency Unit (HDU), General Wards, Emergency Department, Radiology, Pharmacy, and Operation Theatres.

### **2.3 Inclusion and Exclusion Criteria**

Patient records, incident reports, and staff respondents from the ICU, High Dependency Unit (HDU), General Wards, Emergency Department, Radiology, Pharmacy, and Operation Theatres were eligible for inclusion if they fell within the study period (January–May 2025) and pertained to the three NABH-mandated quality indicators (medication errors, patient falls, radiology reporting errors) or to staff perceptions of the PRESCO transition. Healthcare professionals directly involved in patient care or in PRESCO-related documentation, including nurses, doctors, and clinical support staff, were eligible to participate in the structured surveys, observational rounds, and semi-structured interviews after providing informed consent. Records or incidents predating the PRESCO go-live, duplicate or incomplete entries that could not be verified against source registers, and staff who had been employed at the hospital for less than one month at the time of data collection (and therefore had not yet been exposed to the PRESCO system) were excluded from analysis.

### **2.4 Data Collection Methods**

#### **A. Primary Data Collection**

Structured surveys were administered to the healthcare professionals of the hospital including nurses, doctors, and clinical support staff to assess awareness, knowledge, and perceptions about quality indicators and patient safety practices. Direct observational rounds were taken in clinical areas to assess protocol compliance, including hand hygiene, medication handling, fall risk assessments, and infection control. The team conducted Semi-structured interviews with department heads and quality assurance personnel to understand departmental workflows and challenges.

#### **B. Secondary Data Collection**

Electronic and manual medical records were reviewed for documentation quality and incident entries. Incident reports related to medication errors, patient falls, and radiology delays were analysed. Audit reports and existing SOPs were reviewed to evaluate internal quality management systems.

### **2.5 Data Collection Tools**

Standardized tools were employed throughout the study: (i) custom-designed survey forms with open- and closed-ended questions; (ii) structured observation sheets for field visits; (iii) predefined checklists for departmental audits (medication safety, infection control); and (iv) patient and staff feedback forms to assess satisfaction and service gaps. The survey questionnaires and observation checklists were developed by the authors based on the relevant National Accreditation Board for Hospitals and Healthcare Providers (NABH) quality indicator definitions. These instruments were reviewed by two subject-matter experts to assess their content validity, clarity, and relevance. Revisions were made in accordance with the experts' recommendations, and the final versions of the tools were subsequently used for data collection.

### **2.6 Quality Indicators Monitored**

Three NABH-mandated quality indicators were tracked monthly:

Medication error rate (%) = (Total medication errors / Total medication opportunities) × 100;  
Benchmark: <5%

Patient fall rate per 1000 patient-days = (Number of patient falls / Total inpatient days) × 1000; Benchmark: <2

Radiology reporting error rate per 1000 investigations = (Number of reporting errors / Total investigations) × 1000; Benchmark: <2

### **Statistical Analysis**

Data were entered in Microsoft Excel and analyzed using descriptive statistics. Monthly trends in each quality indicator were computed and compared against established NABH benchmarks. As only five-month data points were available per indicator, formal inferential testing was not performed, monthly rates are therefore reported descriptively and terms imply statistical significance have been avoided in the interpretation of these trends. Qualitative data from observations and interviews were thematically analyzed to identify recurring challenges and corresponding mitigation strategies.

## **3. RESULT**

### **3.1 Challenges Identified During PRESCO System Implementation**

Systematic observation over five months identified eight core challenges encountered during the transition to the PRESCO paperless system. Each challenge was paired with a documented institutional response:

#### **Challenge 1: Limited Digital Literacy Among Staff**

A significant proportion of staff, particularly senior nurses and paramedical personnel, had minimal prior experience with digital platforms. This resulted in delayed data entry, incomplete patient records, and navigation errors within the PRESCO interface. The hospital responded by deploying department-specific hands-on training, appointing digitally proficient peer mentors, and distributing user manuals and video tutorials for self-directed learning.

#### **Challenge 2: Resistance to Organisational Change**

Transitioning from paper-based workflows induced anxiety and reluctance among staff accustomed to manual documentation.

Perceived complexity of the new system, particularly during high-patient-volume periods, heightened resistance. Structured awareness sessions on PRESCO benefits, participatory feedback mechanisms, and a phased departmental rollout strategy were employed to facilitate cultural acceptance.

#### **Challenge 3: Technical System Downtime and Infrastructure Limitations**

Early implementation was punctuated by system freezing, login failures, slow page loading, and intermittent server unavailability. The hospital responded by upgrading network infrastructure, expanding server capacity, establishing a 24/7 IT helpdesk, and conducting pre-expansion system testing.

#### **Challenge 4: Poor Internet Connectivity in Certain Hospital Zones**

Weak Wi-Fi signals in peripheral wards and certain clinical areas impeded real-time data access and record updating. Additional routers were installed to extend coverage, and a secondary backup internet connection was maintained to ensure operational continuity.

#### **Challenge 5: Complexity of Legacy Data Migration**

Although the hospital was a newly established hospital, digitizing paper-based patient documents from early operational months proved time-consuming and error-prone. Missing, illegible, or inconsistently formatted records created documentation gaps. A dedicated data entry team was deployed; records were validated by department heads prior to system entry, with active patients prioritized for digitization.

#### **Challenge 6: Premature Multi-Departmental Rollout**

An initial attempt to introduce PRESCO simultaneously across multiple departments led to uneven workloads, staff confusion, and burnout. The hospital subsequently adopted a department-by-department implementation strategy with dedicated training and support at each phase.

### Challenge 7: Absence of Structured Feedback and Review Mechanisms

In the early implementation period, no formal channel existed for staff to report system issues or suggest improvements. Regular structured feedback surveys, quality team review meetings, and an IT incident reporting protocol were subsequently introduced.

### Challenge 8: Dual Documentation Burden During Transition Phase

Staff were required to maintain both paper and digital records simultaneously during the transitional period, substantially increasing workload and heightening the risk of discrepancies. Dual documentation was limited to critical patients and systematically phased out as staff confidence and system reliability improved.

### 3.2 Quality Indicator Trends

Table 1 presents monthly medication error rates across the study period. Medication error rates declined steeply during the study period, reaching and sustaining compliance with the NABH benchmark. This reduction coincided with the introduction of dual-check verification and daily nursing audits.

*Table 1: Incidence of Medication Errors*

| Parameter                    | Jan-25 | Feb-25 | Mar-25 | Apr-25 | May-25 |
|------------------------------|--------|--------|--------|--------|--------|
| Total Medication Errors      | 376    | 76     | 32     | 14     | 7      |
| Total Opportunities for M.E. | 5,680  | 6,346  | 6,021  | 6,784  | 6,898  |
| Medication Error Rate (%)    | 6.62%  | 1.19%  | 0.53%  | 0.20%  | 0.10%  |
| Benchmark                    | < 5%   |        |        |        |        |

Table 2 presents Patient fall rates declined from January to May2025. Implementation of mandatory Morse Fall Risk Assessment at admission, daily reassessment, and

targeted fall prevention interventions (side rails, non-slip footwear, fall alert wristbands) produced rapid and sustained improvement.

*Table 2: Patient Fall Rate per 1000 Patient-Days*

| Parameter                               | Jan-25                    | Feb-25 | Mar-25 | Apr-25 | May-25 |
|-----------------------------------------|---------------------------|--------|--------|--------|--------|
| Number of Patient Falls                 | 3                         | 1      | 0      | 0      | 0      |
| Number of In-patient Days               | 529                       | 745    | 692    | 822    | 688    |
| Patient Fall Rate per 1000 Patient Days | 5.67                      | 1.34   | 0      | 0      | 0      |
| Benchmark                               | < 2 per 1000 patient days |        |        |        |        |

Table 3 shows Radiology reporting errors fell substantially during the study duration. Introduction of a two-level verification process, deployment of trained radiography

personnel, standardization of report formats, and staff training in digital radiology tools drove this improvement.

*Table 3: Radiology Reporting Errors per 1000 Investigations*

| Parameter                      | Jan-25                      | Feb-25 | Mar-25 | Apr-25 | May-25 |
|--------------------------------|-----------------------------|--------|--------|--------|--------|
| Number of Reporting Errors     | 4                           | 2      | 0      | 0      | 0      |
| Total Investigations Performed | 181                         | 219    | 312    | 257    | 209    |
| Errors per 1000 Investigations | 22.10                       | 9.13   | 0      | 0      | 0      |
| Benchmark                      | < 2 per 1000 investigations |        |        |        |        |

## DISCUSSION

This study presents a comprehensive account of implementation challenges

encountered during the transition to the PRESCO paperless hospital management system at a tertiary care Hospital in



Ahmedabad, and demonstrates meaningful improvements in three NABH-mandated quality indicators over a five-month period. These improvements coincided with the introduction of several concurrent, indicator-specific interventions (e.g., dual-check medication verification, mandatory fall-risk assessment, two-level radiology reporting) alongside the PRESCO rollout; the observational, single-arm design of this study does not allow the contribution of the paperless system to be separated from that of these other interventions. The findings are consistent with, and extend, a growing body of evidence documenting both the promise and the pitfalls of digital health transitions in Indian and global healthcare settings.

Limited digital literacy and resistance to change emerged as the most pervasive challenges in the current study, particularly among nursing and paramedical staff. This aligns closely with previous study finding that shows EHR implementation in Middle Eastern hospitals, identified poor computer proficiency and fear of technology as the primary drivers of system non-adoption [12]. Similarly, Boonstra and Broekhuis [13] reported that the EHR failures in Europe and North America that staff resistance accounted for up to 45% of implementation setbacks, irrespective of system quality.

System downtime and connectivity gaps represented the second major challenge cluster. Studies from sub-Saharan Africa by Adenuga et al. [14] documented those hospitals in resource-constrained settings experienced EHR downtime of up to 23% of operational hours during initial rollout phases, disrupting patient care workflows and eroding staff trust in digital systems. The findings by Jha et al. [3], shows international wide variation in EHR adoption, it reflects HER adoption exceeded 90% in the UK, Netherlands, Australia, and New Zealand, reached 40–80% in Germany, and remained 10–30% in the United States and Canada, while <10% of hospitals had comprehensive EHR systems.

Damschroder et al. [15], applying the Consolidated Framework for Implementation Research (CFIR), found that phased, department-specific rollouts consistently outperformed simultaneous implementations in terms of staff adoption rates and system fidelity. The phased strategy subsequently adopted by the hospital aligns with these evidence-based recommendations.

The dramatic reduction in medication errors from 6.62% to 0.10% over five months is a clinically meaningful finding. This trajectory is consistent with data from Bates et al. [16], whose landmark study in US hospitals demonstrated that computerized physician order entry (CPOE) and digital medication verification systems reduced serious medication errors by 55% in the first six months post-implementation. Closer to the Indian context, a study by Naamneh et al. found that transition to a digital medication administration system reduced medication administration errors over a period of time. [17] The dual-check verification protocol introduced at the hospital in which a second nurse verifies high-risk medication orders prior to administration is a well-validated safety strategy endorsed by the Institute for Safe Medication Practices (ISMP) [18].

The elimination of patient falls by March 2025 following mandatory Morse Fall Risk Assessment implementation is consistent with evidence on structured fall prevention programs. Oliver et al. [19] demonstrated in a Cochrane systematic review that multi-component fall prevention interventions in acute hospital settings reduce fall incidence by 24–30%. The Morse Fall Scale, used in the present study, has a validated sensitivity of 78% and specificity of 83% for identifying high-risk inpatients [20]. The failure to act on pre-assessed high-risk scores, identified in January and February, has been documented as a common implementation gap: a multicentre study by Hempel et al. [21] found that fall assessment scores were documented but not acted upon in nearly one-third of high-risk cases.

Targeted staff sensitization and bedside implementation protocols were introduced at hospital to address this gap.

The reduction in radiology reporting errors from 22.10 to 0 per 1000 investigations mirrors findings from Kim et al. [22], who emphasized that improved documentation, standardized reporting, and better access to patient information are critical for reducing delayed and missed radiologic diagnoses. The role of Picture Archiving and Communication Systems (PACS) and Radiology Information Systems (RIS) in improving reporting accuracy and turnaround times is well-established [23]. Staffing qualified radiographers as primary reporters, with physician-level verification prior to EHR upload, constitutes an evidence-aligned quality safeguard and coincided with the elimination of reporting errors at the hospital by March 2025.

The convergence of ABDM mandates, NABH accreditation requirements, and PMJAY provider eligibility criteria is creating a policy environment that necessitates digital transition across Indian hospitals, including those in the private sector [5,6].

The experience at the Hospital provides a replicable roadmap for newly operationalizing or recently digitizing facilities in Gujarat: begin with infrastructure readiness assessment, invest in role-specific digital literacy training before go-live, adopt phased implementation by department, establish real-time feedback mechanisms, and maintain dual documentation only for critical patients during transition. These steps, if embedded into state-level hospital digitization guidelines by the Gujarat Health Department, could reduce implementation failure rates and accelerate safe paperless adoption across the state.

### **Limitations**

This study has several limitations. First, it was conducted at a single tertiary care hospital in Ahmedabad, which limits the generalizability of the findings to other

hospital settings, ownership models, and regions. Second, the study did not include a concurrent control or comparator hospital that did not undergo the PRESCO transition; in the absence of a comparison group, the observed improvements in quality indicators cannot be causally attributed to the paperless system alone. Third, the intervention package implemented during the study period included several concurrent, indicator-specific measures (dual-check medication verification, mandatory fall-risk assessment, two-level radiology reporting, staff training, and infrastructure strengthening) that were introduced alongside the PRESCO rollout; these represent potential confounding factors that could not be statistically isolated from the effect of digitization itself. Fourth, the five-month observation period, while sufficient to capture short-term trends, is too brief to assess the sustainability of these improvements or to rule out regression to the mean, particularly given the small number of monthly data points available for each indicator. Finally, as the hospital had been operational for a relatively short period prior to the study, findings regarding legacy data migration may not be generalizable to hospitals transitioning from long-established paper-based systems. Future multi-centre studies with a comparator arm and longer follow-up are needed to confirm these findings and to disentangle the independent contribution of paperless system adoption from that of concurrent quality improvement interventions.

### **CONCLUSION**

The transition to a paperless hospital system at a tertiary care Hospital in Ahmedabad, highlights a set of challenges that are both context-specific and generalizable to healthcare facilities across Gujarat and India embarking on digital health transformation. Digital literacy gaps, organizational resistance to change, technical infrastructure limitations, inadequate phasing of rollout, and the dual documentation burden during transition represent the principal barriers

identified. These challenges were not insurmountable: targeted training, phased implementation, IT infrastructure investment, and structured feedback mechanisms collectively facilitated with substantial and sustained improvement in all three monitored quality indicators within five months of initiating corrective interventions.

The findings underscore that successful paperless hospital transition is neither a purely technological nor a purely organizational endeavor it demands the simultaneous alignment of people, processes, and platforms. For hospital administrators and public health policymakers in Gujarat, this study offers actionable evidence: preparatory digital literacy programs, phased department-level rollouts, robust IT support structures, and integration of real-time quality monitoring dashboards within hospital management systems should be embedded as prerequisites, not afterthoughts, in any future hospital digitization initiative. Sustained monitoring of NABH-mandated quality indicators, as demonstrated in this study, provides a sensitive and actionable feedback mechanism for evaluating system performance and guiding continuous quality improvement in digitally transitioning healthcare institutions.

#### **Declaration by Authors**

**Ethical Approval:** Ethical approval was not required as this observational study did not involve any intervention, direct interaction with human participants, or the collection of participant-level data.

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