ISB Max Institute of Healthcare Management

Post-Adoption Value of NABH Digital Health Standards

A Multi-Hospital Assessment in India

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Published by

Max Institute of Healthcare Management,
Indian School of Business, Sector 81, Knowledge City, SAS Nagar, Mohali - 140 306.
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Citation

Rath, S., Deo, S., Nandwani, R., Saini, N., Jain, V. M., Whorra, T., & Kant, D. (2026). *Post-adoption value of NABH Digital Health Standards: A multi-hospital assessment in India*. Max Institute of Healthcare Management, Indian School of Business.

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Executive Summary

Hospitals worldwide are steadily digitalising as governments accelerate national digital health planning (WHO, 2025). In India, this shift is unfolding rapidly amid expanding digital infrastructure and policy push, calling for a standard framework that brings consistency to emerging practices and guides hospitals toward a strong digital health ecosystem (Paul et al., 2025). NABH's Digital Health Standards (DHS), launched in 2023, formalised this through a three-tier certification (Silver, Gold, Platinum) assessing hospitals' digital maturity. But despite rapid uptake, hospital-grounded evidence on implementation experience and outcomes remains scarce. Existing research has focused on DHS's design rather than why hospitals pursue it, what it costs them, or its post-adoption value. This is the gap the current study addresses.

This white paper presents an independent, pan-India assessment of NABH DHS's post-adoption value, conducted by the Max Institute of Healthcare Management (MIHM), ISB. It covers 20 hospitals across sizes, accreditation levels, and metro/non-metro locations, combining qualitative interviews with a quantitative survey of hospital leaders to compare pre- and post-adoption expectations.

This study finds that hospitals pursue DHS certification primarily to improve operational efficiency and care quality, not just for regulatory compliance. Adoption is largely leadership-driven, with certification used to signal quality and digital maturity to patients, insurers and peers. The effort during the certification process was concentrated in a consistent set of areas: staff training and behavioural change, workflow and process redesign, system integration and interoperability, and cybersecurity and infrastructure build-out. Behavioural change and sustained clinician engagement are key to the success of these efforts. Adoption of individual clinical systems broadened sharply during the certification period, where EHR, RIS/PACS, and other specialised systems each grew by 25 percentage points, while core hospital information systems, already near-universal pre-DHS (89%), saw only marginal further gains.

In return, hospitals report clear gains, with overall value rated highest (4.62 on a 5-point scale), closely followed by Data Privacy and Documentation Quality (4.56 each), Operational Efficiency (4.38), and Interoperability (4.29), with hospitals that invested greater implementation effort reporting significantly stronger gains across nearly every dimension.

Hospitals describe DHS not as an end goal but as a framework that standardises and formalises the digitalisation already underway, with experiences varying more by hospital size, baseline digital maturity, and leadership commitment than by metro/non-metro location. After initial certification, hospitals are better positioned to adopt automation and AI-powered tools, progress across certification tiers, and integrate with the Ayushman Bharat Digital Mission (ABDM) to plug into India's national digital health ecosystem.

Figure 1: Key findings from the quantitative analysis

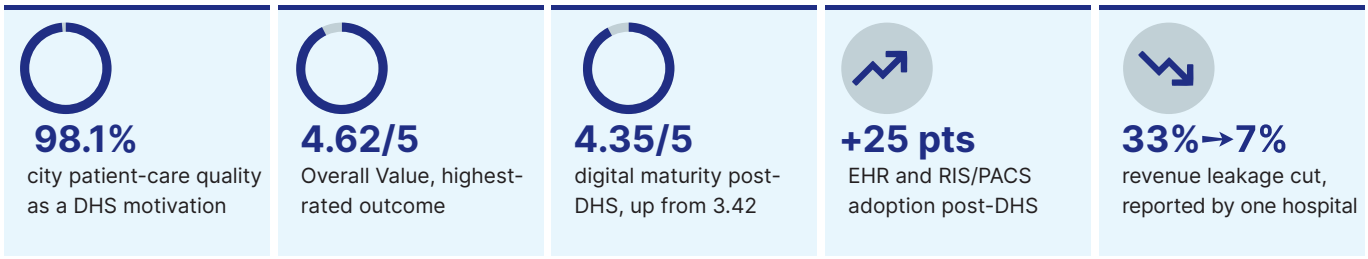


Figure 2: Key DHS-related effort areas and gains

1 Introduction

Digital technologies are reshaping healthcare delivery worldwide by improving quality, safety, efficiency, and continuity of care (WHO, 2021). In India, this shift has gained momentum through a mix of policy initiatives, technological advances, and rising expectations from patients and providers for data-driven care (Singh et al., 2024). As hospitals progress on this journey, they increasingly need structured frameworks to guide, assess, and benchmark digital maturity, without which digital investments are difficult to measure or hold accountable (Adapa et al., 2025).

In response, NABH introduced the Digital Health Standards (DHS) in September 2023, an accreditation framework to assess and promote digital health adoption across governance, clinical and administrative information management, cybersecurity, patient safety, interoperability, and technology use. The framework comprises eight chapters, 38 standards, and 182 objective elements, graded into Core, Commitment, Achievement, and Excellence categories, with a hospital's cumulative performance determining its certification level.

DHS operates through three progressive levels: **Silver** (foundational digital capabilities), **Gold** (deeper integration and stronger governance), and **Platinum** (advanced, organisation-wide digital maturity). Hospitals may apply for any level based on their own internal assessment of readiness, with only the objective elements relevant to the applied level considered for evaluation. Certification is independently evaluated through external assessment, with accreditation valid for four years (subject to a renewal review at 24 months) and certification valid for two years, after which the hospital must reapply to maintain its status.

DHS is not simply a technology audit. Achieving certification requires hospitals to invest in infrastructure, redesign workflows, strengthen governance, build staff capacity, and embed digital practices into daily operations, making it a significant organisational commitment. Hospitals pursue certification for varied reasons: operational efficiency, stronger patient safety systems, reputational value, process standardisation, or broader digital transformation goals.

Most existing discussion has focused on the standards themselves and their role in India's digital health ecosystem. However, little is known about *why* hospitals pursue certification, what challenges they face, what it costs, and whether it delivers lasting value post-adoption. This evidence gap matters for multiple audiences: hospitals weighing certification need realistic guidance on requirements and outcomes; NABH and policymakers need to understand how DHS functions in practice to strengthen the framework and ensure it drives genuine improvement rather than becoming a compliance exercise.

This white paper presents findings from an independent study by the Max Institute of Healthcare Management (MIHM), Indian School of Business (ISB), assessing the post-adoption value of NABH DHS. The study uses a mixed-methods approach, combining a quantitative survey with in-depth interviews across hospital leadership, quality, IT, operations, and clinical teams. The study selected hospitals to reflect variation in accreditation level, size, and metro/non-metro location.

By capturing the experiences of hospitals that have completed certification, this study contributes practical, evidence-based insights for hospitals, policymakers, and accreditation bodies working to accelerate meaningful digital transformation in healthcare. Findings reflect the perceptions of early adopters and rely substantially on self-reported experience rather than independently audited outcomes. Results should be interpreted with this limitation in mind.

2 Purpose of Study

The study examines the practical experiences of hospitals that have already undergone certification to assess the range of benefits DHS delivers across various areas once the certification process is complete. Instead of assessing the standards themselves, this study pursues four interconnected objectives.

Figure 3: Objectives of the study

1. **Understanding the Drivers of Adoption**

   The study identifies and characterises the motivations that lead hospitals to pursue DHS certification, regulatory incentives or compliance requirements, competitive and reputational considerations (signalling digital maturity to patients), or expectations of tangible operational improvements.

2. **Examining the Implementation Experience**

   Adoption is not a single event but an organisational process that unfolds over time. The study examines the scale of organisational effort required for DHS implementation, including resources invested, changes made to existing systems and processes, challenges encountered, and the role of external support such as vendors.

3. **Comparing Pre-Adoption Expectations with Post-Adoption Realities**

   A core analytical focus is an assessment of the alignment between what hospitals anticipated from DHS adoption and what they actually experienced, across regulatory, operational and clinical, financial and signalling outcomes.

4. **Generating Evidence to Inform Policy and Practice**

   Beyond its descriptive aims, the study is designed to produce findings useful for a range of stakeholders, evidence-based perspectives for hospitals considering DHS adoption, and, for NABH and policymakers, a view of implementation challenges and where the standards framework or its supporting infrastructure may benefit from refinement.

3 Methods

3.1 Study Design

This study employs a concurrent mixed-methods design, combining qualitative and quantitative data collection carried out simultaneously. In-depth qualitative interviews were conducted with key stakeholders across DHS-certified hospitals to understand implementation experiences, mechanisms of value creation, and contextual factors shaping adoption outcomes. Alongside the interviews, a structured quantitative survey was shared with the same stakeholders, yielding 52 responses. Together, the two approaches provide both depth of understanding and breadth of coverage across the sample.

3.2 Setting and Context

This study was conducted among hospitals in India that have achieved NABH DHS certification. India's hospital sector is highly heterogeneous, varying widely in size, ownership, geographic setting, resource availability, and baseline digital infrastructure. A large private hospital in a metropolitan centre and a small facility in a tier-2 city may be at a very different position on the digital maturity spectrum while holding the same certification.

3.3 Sampling Strategy

Given the heterogeneity of the DHS-certified population, a probability sampling approach would risk under-representing the tiers and hospital types most relevant to the study's aims. The study therefore adopted a stratified purposive sampling strategy, combining defined stratification dimensions with the purposive selection of information-rich cases within each stratum (Palinkas et al., 2015). The study targeted a final sample of 20 NABH-certified hospitals, selected across accreditation tiers, size categories, and metropolitan/non-metropolitan contexts. The sample deliberately weighs toward smaller and non-metropolitan hospitals, not intended to be statistically representative of the DHS-certified population but to maximise ariation across the dimensions most likely to shape adoption experience.

Figure 4: Total sample distribution of hospitals by accreditation level, hospital size, and geography

ACCREDITATION	SMALL	MEDIUM	LARGE	TOTAL
Silver	2 4	3	1	10
Gold	1	1 2	1	5
Platinum	1	2 1	1	5
TOTAL	8	9	3	20

Metro Non-metro

3.4 Stratification Framework

3.4.1 Accreditation Tiers

As of the time of this study, 160 hospitals across India had achieved DHS certification. The three certification tiers - Silver, Gold and Platinum - serve as a primary stratification variable, as post-adoption value is likely to differ meaningfully across them.

Figure 5: Certified hospitals across different accreditation levels

3.4.2 Hospital Size

Resource availability, IT infrastructure and organisational capacity, all of which shape DHS adoption and its perceived value, vary significantly by size. Large hospitals (above 300 beds), medium hospitals (100-299 beds), and small hospitals (below 100 beds) are each represented, with the sample weighted toward medium and small facilities to capture implementation challenges at those levels.

3.4.3 Geographic Classification

Digital health infrastructure, connectivity and workforce capacity differ between metropolitan and non-metropolitan settings. Metropolitan hospitals are those located in eight designated cities: Ahmedabad, Bengaluru, Chennai, Delhi (including Gurgaon and Noida), Hyderabad, Kolkata, Mumbai and Pune. All other locations, tier-2 cities, district headquarters, and rural settings are classified as non-metropolitan. The sample is weighted toward non-metropolitan hospitals, consistent with the study's focus on adoption barriers in resource-constrained settings.

Three deliberate design decisions shaped the final sample. First, the sample included all three accreditation tiers, including the less common Platinum tier. Second, small and medium hospitals were intentionally over-represented relative to their share of the certified population, to surface barriers and enablers among resource-constrained facilities. Third, the sample was balanced across metro and non-metro settings to allow comparison across contexts with differing infrastructure and workforce capacity.

3.5 Participants

A single pool of participants was drawn from the 20 sampled hospitals, with quantitative respondents being a subset of qualitative participants. The qualitative component involved in-depth interviews with 80 senior stakeholders responsible for, or closely involved in, the DHS certification process, including CEOs, CIOs, CFOs, and heads of Quality, Operations, Clinical, and Nursing functions. Because some individuals held more than one portfolio (e.g., a combined Quality and Operations role), these 80 participants represented 93 distinct functional roles across the sample. The quantitative component comprised a structured survey completed by 52 respondents drawn from the same pool across the same 20 hospitals.

Table 1: Interview participants and functional roles by accreditation tier and hospital size

ACCREDITATION LEVEL	SMALL	MEDIUM	LARGE	TOTAL
	INDIVIDUALS / ROLES	INDIVIDUALS / ROLES	INDIVIDUALS / ROLES	INDIVIDUALS / ROLES
Silver	21 27	12 14	7 6	40 47
Gold	4 6	11 11	3 3	18 20
Platinum	6 5	11 16	5 5	22 26
Total	**31 38**	**34 41**	**15 14**	**80 93**

Individuals **Roles**

Table 2: Survey respondents by accreditation tier, hospital size, and geographical category

ACCREDITATION LEVEL	SMALL	MEDIUM	LARGE	TOTAL	GRAND TOTAL
	METRO / NON-METRO	METRO / NON-METRO	METRO / NON-METRO	METRO / NON-METRO	
Silver	7 8	0 8	0 7	7 23	**30**
Gold	0 3	4 1	0 3	4 7	**11**
Platinum	0 3	5 0	3 0	8 3	**11**
Total	**7 14**	**9 9**	**3 10**	**19 33**	**52**

Metro **Non-metro**

4 Comparative Analysis of Themes Across Hospital Size and Geography

The findings in this section draw on the interviews and survey responses described in Section 3, collected across the 20 sampled DHS-certified hospitals. Qualitative interview data were analysed in two complementary ways: responses were sorted into comparative categories to examine how implementation experience varied across hospital size and location, and thematic analysis was used to identify recurring themes cutting across the sample. The 52 quantitative survey responses were analysed descriptively to capture pre- and post-certification digital maturity, implementation effort, motivations and perceived outcomes. The two datasets were analysed independently and then triangulated for common themes. What follows presents each theme, combining the qualitative account and quantitative results.

Figure 6: Thematic areas across hospital size and geography

PRE-CERTIFICATION

4.1 Drivers of Adoption and Certification Pathways

The section examines hospitals' motivations for pursuing DHS certification, as well as the factors influencing their choice of certification level.

Motivations for Pursuing Certification | Decision for Certification Level

4.2 Organisational Readiness and Transformation Requirements

The section examines the organisational readiness, transformation requirements, and key adoption challenges associated with DHS implementation.

Major Changes Required for DHS | Readiness Challenges & Adoption Strategies | Implementation Approach | Financial Investments

DURING CERTIFICATION

4.3 Technology Infrastructure, IT Effort & Interoperability

The section discusses how hospitals constructed the technology infrastructure required for DHS implementation and the IT effort necessary.

Level of IT Effort & Technical Demand | Capability to Address the Changes Required

4.4 Workflow Redesign and Clinical Usability

The section examines how hospitals redesigned clinical and administrative workflows to align with DHS requirements.

4.5 Key Areas of Investment

This section examines the financial implications of adopting NABH DHS, including upfront investments and the recurring and hidden costs associated with compliance.

POST-CERTIFICATION

4.6 Post-Certification Value and Outcomes

The analysis presented in this section explores the value hospitals realized after DHS certification and the changes they observed in day-to-day functioning across five areas: clinical quality and patient safety; operational efficiency & workflows; resource & financial efficiency; governance & compliance; and digital maturity.

Clinical Quality & Patient Safety | Operational Efficiency & Workflows | Financial Efficiency | Governance & Compliance | Digital Maturity & Cybersecurity

4.7 Sustainability of Adoption and Compliance Mechanism

This section explores the mechanisms hospitals use to sustain DHS adoption and maintain compliance following certification.

4.1 Drivers of Adoption and Certification Pathways

This section examines why hospitals pursue DHS and how they decide which certification level to target.

Table 3: Adoption drivers and certification-level decisions by hospital size

MOTIVATIONS FOR PURSUING CERTIFICATION

SMALL	MEDIUM	LARGE
• Improving operational efficiency • Ease of use for patients and staff • Standardisation of processes	• Move from partial digitisation to maturity • Integration of systems working in silos • Data governance and audits	• DHS seen as a stepping stone in the long-term digitisation goal • Scaling of operations and pioneer positioning • Clinical transformation and advanced analytics

CROSS-TIER INSIGHT: *DHS adoption is not perceived for compliance, but for overcoming operational inefficiencies, improving patient safety, and providing hospitals with a framework to organise unintegrated digital systems.*

DECISION FOR CERTIFICATION LEVEL

SMALL	MEDIUM	LARGE
• Choose lower levels and gradually scale	• Based on the readiness of the unit and digital maturity • Decision made on the basis of cost, benefit and risk analysis	• Certification level based on long-term vision and competitive priorities

CROSS-TIER INSIGHT: *Certification level is a strategic decision, not purely technical.*

4.1.1 Motivations for Pursuing Certification

Hospitals primarily pursue DHS to improve patient care and operational performance. This aligns with the literature on management innovations, which suggests that early adopters are more likely to adopt for functional and efficiency-related reasons than for legitimacy or conformity (Westphal et al., 1997). Survey findings reinforce this interpretation. Improving patient care quality was selected by 98.1% of respondents, followed by improving operational efficiency (88.5%).

The nature of expected improvement differed by hospital size. Small hospitals emphasised streamlining key workflows such as billing and documentation, and establishing more reliable, well-organised processes, with better record management and standardisation to support safer care.Medium-sized hospitals focused on integrating standalone systems, connecting departments, and improving information sharing to reduce communication gaps and support clinical decision-making. Shared access to records was expected to support inter-departmental coordination, reduce communication gaps, and enhance patient safety.

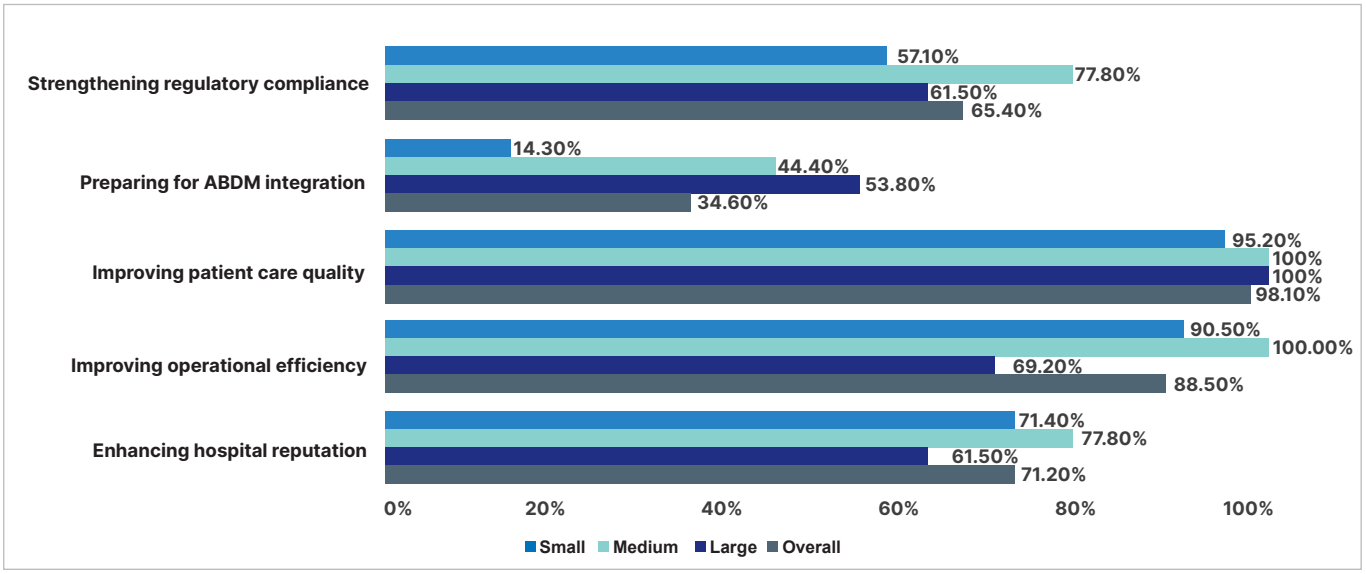
Large hospitals saw DHS as supporting a broader strategic agenda around optimisation, scalability and data-driven decision-making, most already had relatively mature digital infrastructure. This made DHS less a starting point for large hospitals and more an opportunity to extend and consolidate existing systems. Alongside this, hospitals expected real-time visibility to replace slow, manual oversight loops.

> *"Before DHS, after an incident happened a physical form was filled, and we had to wait till the form came to do Root Cause Analysis (RCA). Now, the RCA is done on the system itself."*
>
> QUALITY HEAD · LARGE · PLATINUM · METRO

According to the quantitative survey, when disaggregated by hospital size, improving operational efficiency was cited by 100% of medium hospitals and 90.5% of small hospitals, but only 69.2% of large hospitals. Preparing for ABDM integration showed the opposite gradient, rising steadily from 14.3% among small hospitals to 44.4% among medium hospitals and 53.8% among large hospitals.

Overall, while the starting points differ across hospital segments, DHS adoption consistently evolves beyond compliance. It becomes a tool for improving operational discipline, enabling integration, and strengthening the role of data in driving clinical and administrative decisions.

Figure 7: Motivations for pursuing DHS certification



**Respondents could select more than one motivation. Percentages reflect the proportion of respondents citing each motivation and do not sum to 100%.*

4.1.2 Decision for Certification Level

Across sizes and locations, infrastructure and vendor access were the main factors shaping which certification tier a hospital targeted. Many hospitals treated certification level as a tactical choice, progressing gradually from Silver to Gold to Platinum, choosing a level that was achievable and sustainable rather than aspirational.

Because of infrastructure constraints and dependence on vendors, smaller hospitals typically begin at the lower accreditation levels, picking what they can realistically handle. However, entering low was not always a constraint. In some cases, it was a deliberate choice and a learning strategy.

Medium hospitals made a more balanced call, weighing costs, benefits and risk, one CIO advised following *"a clear roadmap going from Silver to Gold to Platinum,"* noting that *"clear demarcation between Silver, Gold helps"*. Another medium, gold, non-metro hospital that could have pursued Platinum chose Gold instead because ABDM integration was viewed as a cybersecurity liability. The CEO at a medium, platinum, non-metro facility points out, *"This is a game of the vendor. If he gives you a product that makes you capable of platinum, you get platinum."*

Larger hospitals seem to indicate a more strategic approach, linking certification to their long-term vision and competitive priorities. These hospitals framed the decision around first-mover signalling rather than around the level itself: one targeted Platinum to be one of the first to achieve Platinum certification in India.

KEY TAKEAWAYS

1. DHS was pursued primarily to improve efficiency, standardise processes, and strengthen digital maturity, rather than for compliance alone.
2. Certification levels were chosen based on organisational readiness, digital maturity, and vendor capability.
3. Larger hospitals linked DHS to long-term strategy, scaling, and market positioning.

4.2 Organisational Readiness and Transformation Requirements

This section highlights the challenges hospitals face, the changes required to achieve digital maturity, and the factors that influence successful adoption.

A consistent theme runs through these findings: the central challenge lies less in **deploying digital systems** than in **embedding them into everyday clinical practice,** making implementation as much a **people-and-process endeavour** as a technical one.

Table 4: Organizational readiness and transformation by hospital size

MAJOR CHANGES REQUIRED FOR DHS

SMALL	MEDIUM	LARGE
• Build end-to-end digital ecosystems • Eliminate paper record dependency	• Shift to fully integrated digital ecosystems • Workflow standardisation	• Shift to actual clinical usage of the systems • Alignment of IT and clinical behaviour • Real-time data tracking and usage of dashboards

CROSS-TIER INSIGHT: *The transformation path advances from digitisation and paper reduction to workflow integration, ending in clinical acceptance and real-time data-driven decision-making.*

READINESS CHALLENGES AND ADOPTION STRATEGIES

SMALL

- Infrastructure constraints and vendor dependence
- Paper-based/hybrid processes
- Low digital literacy
- Vendor-led handholding and leadership-driven adoption

MEDIUM

- Siloed systems, fragmented workflows and inconsistent usage
- Data quality and coordination issues
- Coexistence of manual and digital systems

LARGE

- Cross-departmental coordination
- Real-time data utilisation
- AI-enabled tools and adoption incentives

CROSS-TIER INSIGHT: *Clinical adoption and behaviour change are the biggest barriers; change management is critical.*

Technology alone does not ensure adoption.

Continuous training and reinforcement are critical for success.

IMPLEMENTATION APPROACH

SMALL

- Leadership-led
- DHS helps gain digital maturity

MEDIUM

- Mixed (leadership + compliance push, often after NABH accreditation)
- DHS a framework to fix fragmentation, not a starting point

LARGE

- Primarily strategic/leadership-led (not compliance-driven)
- Linked to scaling vision (multi-hospital chains, JCI readiness, Platinum positioning)
- Used to validate digital transformation

CROSS-TIER INSIGHT: *Much of the implementation was driven by leadership, with small hospitals focused on building structure, medium on closing integration gaps, and large on driving real usage.*

FINANCIAL INVESTMENT

SMALL

- Significant investment
- Returns lag spend; phased scale-up

MEDIUM

- Significant investment
- Extra IT budget allocated

LARGE

- Sizeable spend, better-planned, lower perceived burden
- Expense absorbed into routine government budget

CROSS-TIER INSIGHT: *Training is an ongoing cost, especially in high-attrition settings; digital costs are partly offset by operational savings; ROI is unclear, and adoption gaps limit efficiency gains.*

4.2.1 Major changes required for DHS

The changes needed for DHS reflect a broader shift in how care is documented, coordinated and delivered. Most hospitals reported a relatively short preparation period: 55.8% of respondents indicated under 6 months, a further 36.5% reported 6-12 months, and only a small minority required 1-2 years (5.8%) or more (1.9%).

For smaller hospitals, the shift was about getting the basics right, implementing EMR for the first time and digitising previously paper-based notes and prescriptions. Software also needed to be customised to local requirements rather than using one-size-fits-all solutions. However, the

transition involved behavioural as well as technical change. To ease adoption, familiar interfaces and workflows, such as digital pens and digital versions of paper-based templates, were introduced to reduce resistance.

Medium-sized hospitals focused on integrating systems by linking lab, radiology and clinical records, minimising manual processes, and standardising documentation formats. In a medium, silver, non-metro hospital, the trigger was discovering that the same information was being recorded several times over: *"when we sat together, we realised data was already being captured by departments separately."* The realisation these hospitals arrive at is that the point is not having systems but how well they are connected in practice.

In larger hospitals, the change centred on ensuring digital systems were actively used by clinicians and data entered in real time rather than retrospectively. The most cited gap was in clinical workflows. Meeting the standard required developing end-to-end EMR workflows, consolidating documentation processes, and getting rid of residual paper usage.

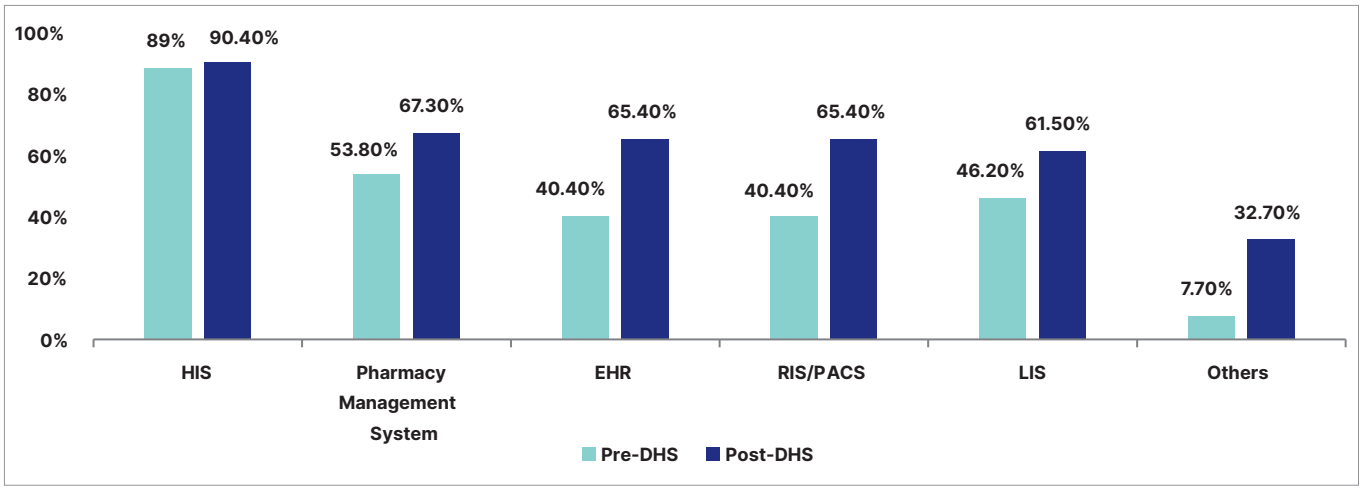
> *"We cleared out 30 nursing registers, now our nursing staff is using only 7–8 registers."*
>
> QUALITY HEAD · LARGE · PLATINUM · NON-METRO

Infrastructure-related changes were a significant amount of work, such as tablet deployment for nurses and medical officers. The journey follows a clear path, from building foundations to integrating systems, and finally to monitoring adoption in real time.

These patterns together hint that the adoption of DHS was generally based on digital infrastructure that hospitals had previously established before certification. The relatively high rate of HIS adoption prior to DHS certification likely reflects the view of hospitals that a basic HIS was a prerequisite rather than an outcome of the DHS journey.

While hospital size shaped the nature of organisational and technological changes required for DHS, geographical location also influenced hospitals' implementation priorities. Metro hospitals focused on improving how they used existing systems, strengthening integration and data quality, while non-metro hospitals focused on building foundations: IT infrastructure, reduced paper dependence, and structured electronic workflows. Both ultimately confronted the same reality: the goal was not simply to digitise records but to ensure digital systems supported clinical care.

Figure 8: Adoption of core digital systems before and after DHS certification



4.2.2 Readiness Challenges and Adoption Strategies

Hospitals seldom described digital transformation as just a technology challenge. Respondents consistently highlighted behaviour change, workflows and organisational routines as the harder tasks. Smaller hospitals leaned on vendor handholding and leadership oversight to manage the shift from paper; some highlighted the persistence of hybrid workflows in the transition phase, leading to increased per-patient time.

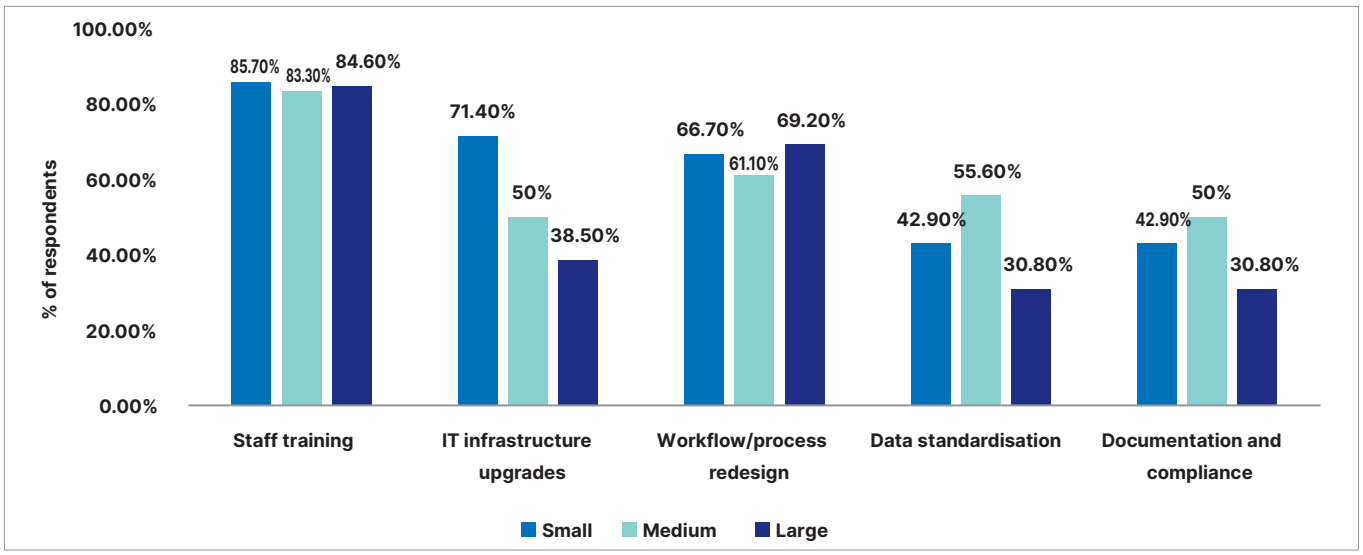
> *"Documentation time has gone from ~1 minute (handwritten) to ~5 minutes (typed), while total per-patient time is now ~30 minutes versus that of 10–15 minutes previously."*
>
> QUALITY HEAD · SMALL · SILVER · METRO

Medium hospitals managed transition periods with informal channels such as WhatsApp groups for quick resolution.

For large hospitals, the challenge was increasingly behavioural, especially among senior clinicians. Hospitals leaned on them to set the example, added support staff or voice-to-text tools so documentation didn't fall to clinicians mid-consultation, and made usage visible through published benchmarks and recognition. Once systems were genuinely in use, the emphasis shifted to regular training, continuous monitoring and on-ground support and engagement.

Quantitative findings corroborate this: staff training was the most difficult implementation effort across all sizes (85.7% small, 83.3% medium, 84.6% large). Detailed findings are illustrated in the graph below.

Figure 9: Areas requiring the most effort during DHS implementation



On a 1–5 effort scale, reported effort declined significantly with size, from **4.38 (small)** to **4.06 (medium)** to **3.69 (large),** while staff readiness showed no significant variation by size **(3.67 / 3.78 / 3.62),** suggesting that while smaller hospitals faced significantly greater implementation effort, this was not accompanied by a correspondingly lower sense of staff preparedness.

At metro hospitals, digital infrastructure was better, but systems were frequently underutilised and poorly integrated into daily workflows. As a result, hospitals developed formal methods for implementing them, with staged rollouts, digital champions, governance committees and formal oversight mechanisms. In non-metro hospitals, challenges included lack of IT capacity, high level of dependence on vendors, and transition from mostly manual to digital operations. Consequently, the preparation was largely focused on staff training, direct leadership involvement, monitoring of compliance, and continuous support.

> *"One common training does not work for everyone. The training material had to be tailored to the needs of the staff."*
> QUALITY MANAGER · MEDIUM · SILVER · NON-METRO

Quantitative findings align closely with these observations. Staff training was cited by 100% of metro respondents compared with 75.8% of non-metro respondents, while workflow redesign was cited by 94.7% of metro respondents compared with 48.5% of non-metro respondents.

These results suggest that metro hospitals experienced DHS implementation as **more disruptive** to existing workflows **despite generally stronger digital infrastructure.** One possible explanation is that metro hospitals often needed to restructure **legacy systems and entrenched work practices,** whereas several non-metro hospitals benefited from **newer systems, standardised chain-hospital platforms, or fewer legacy constraints** (Drummond, 1963).

4.2.3 Implementation Approach

While the decision to pursue DHS was often leadership-led, the pathways to implementation differed depending on hospital size, digital maturity, and organisational priorities. Across hospitals of different sizes, leaders largely drove implementation approaches, though the intent behind adoption varied.

In small hospitals, leadership often directly supported DHS to develop structure and establish basic digital systems. In some instances, hospital leaders personally championed the initiative. As one small, silver, non-metro hospital CEO took rounds in the hospital during the training phase, to reinforce the use of tablets for real-time data entry. Some leaders viewed certification as a mechanism to formalise processes and instil greater operational discipline.

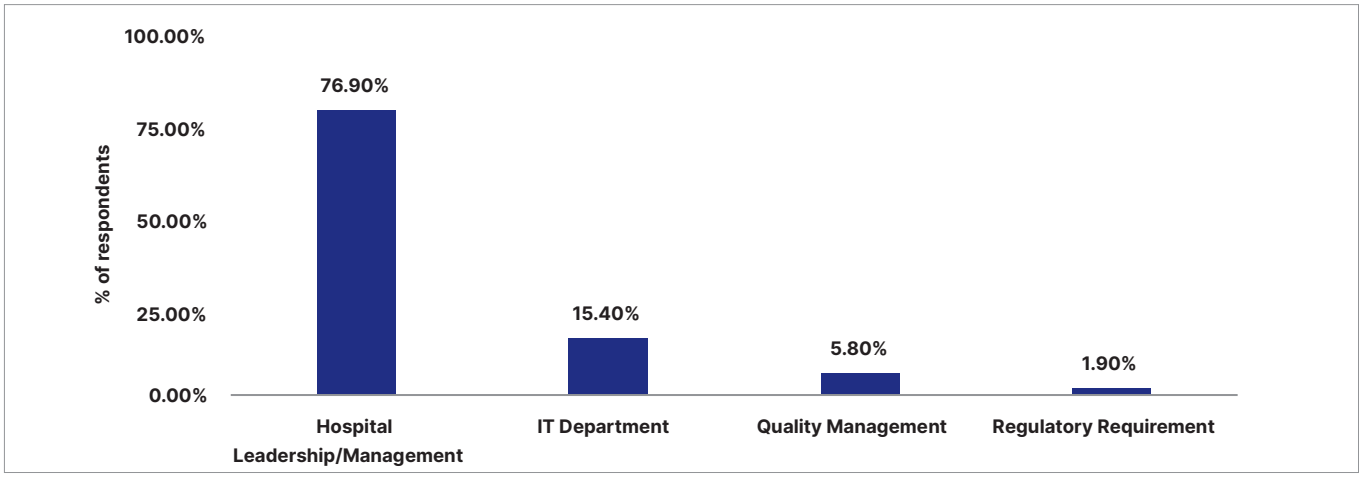
> *"Systems get clear through the certification. Team will start working based on the workflows designed as per the certification needs."*
> CEO · SMALL · PLATINUM · NON-METRO

Medium-sized hospitals usually saw DHS as a way to integrate siloed systems, drawing from the learnings of previous NABH journeys. Larger hospitals, meanwhile, viewed DHS as a tool to advance digital maturity, multi-site standardisation, or readiness for advanced accreditation.

Across all settings, DHS was almost always more than a compliance exercise. Instead, it served as a framework for formalising ongoing digital transformation efforts and driving greater adoption of systems already in place.

The quantitative findings strongly reinforce these qualitative insights. Hospital leadership and management emerged as the overwhelming initiator of DHS certification, identified by 76.9% of respondents as the source of the decision, followed by the IT department (15.4%).

Figure 10: Initiation of decision to pursue DHS certification



This finding reinforces the broader pattern observed in the qualitative thematic analysis, where leadership-led initiation was identified as the dominant driver of DHS adoption at 95% of the 20 hospitals studied. This convergence underscores that DHS adoption in the Indian private hospital sector is predominantly a top-down, leadership-driven undertaking rather than one originating from regulatory pressure.

Metro hospitals tend to follow more structured, process-driven models with distributed responsibility, while non-metro hospitals often rely on more centralised, leadership-driven execution. But these distinctions are not rigid. In practice, what really matters is sustained coordination and consistent follow-through after systems go live.

4.2.4 Financial Investments

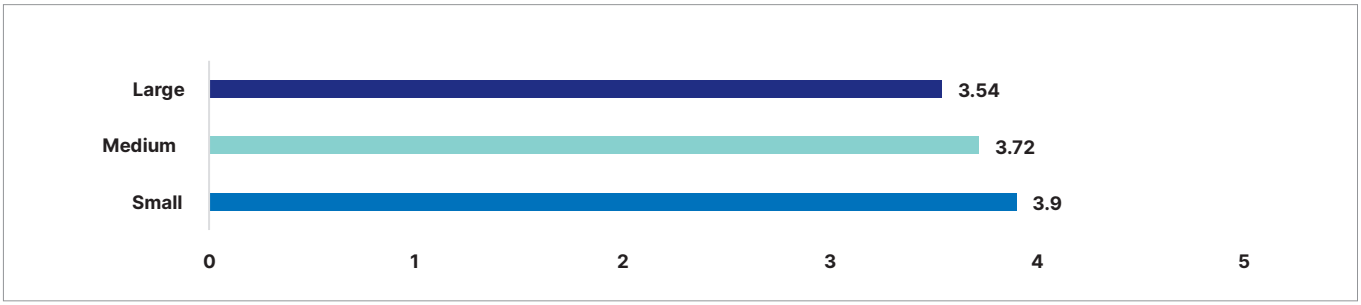
In small hospitals, the financial burden is disproportionately high due to lack of economies of scale, with high investments relative to hospital size, limited patient turnover and lesser ability to absorb hidden and recurring costs. The recurring costs add up as annual maintenance costs, comprehensive maintenance costs (AMC/CMC), as well as 24x7 IT support. Software development and purchase have major cost implications for small hospitals. Despite acknowledging an estimated 15–20% saving on operational costs after digitalisation, a hospital's leadership described the investment-to-return ratio as low for a facility of their size. Reliance on external vendors also amounted to significant costs, particularly for small facilities. To ease the financial burden, most of the small facilities undertook a phased implementation approach.

> *"DHS is a significant financial burden for small facilities. Regardless of the size, we have to invest in systems that align with DHS standards. Larger hospitals have greater revenue, so the costs are relatively bigger for us."*
>
> CEO · SMALL · PLATINUM · METRO

Medium hospitals also face significant costs. A medium, platinum, metro facility reported IT budgets *"increasing twice as much,"* with unclear returns as infrastructure scales faster than adoption. Despite the burden, these hospitals valued DHS mainly for operational efficiencies, such as procurement, stock forecasting, and workflow coordination.

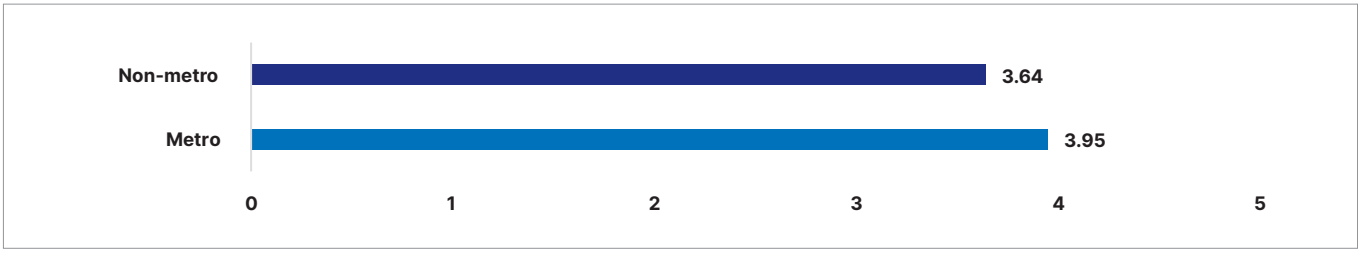
Large hospitals see similar or higher investment but manage it through structured planning, absorbing costs across larger patient volumes. In chain hospitals, the central unit allocates budget and shares infrastructure across facilities. Survey data confirms a declining burden gradient: financial investment scores fell from small (3.90) to medium (3.72) to large hospitals (3.54).

Figure 11: Financial Investment Required for DHS Implementation by Hospital Size (mean 1-5)



Metro IT budgets rose sharply during implementation and post-adoption. A small, silver, metro facility faced hardware delays because *"earlier budgets had already been exhausted,"* showing burden persists even in resource-rich settings, likely due to this facility's small size and specialised (IVF) service line. Survey data shows metro hospitals reporting somewhat higher mean financial investment than non-metro (3.95 vs 3.64). Non-metro budgets skew toward IT infrastructure and training, with training costs elevated by skill gaps and high turnover. In non-metros, budgeting tends to be need-based rather than planned, while gains are consistently reported across settings.

Figure 12: Financial Investment Required for DHS Implementation by Hospital Geography (mean 1-5)



KEY TAKEAWAYS

1. Digital transformation progressed from paper reduction to system integration and ultimately to clinical adoption and real-time data use.
2. Behaviour change and clinician adoption were more challenging than technology implementation.
3. Continuous training, leadership support, and workflow alignment were critical for successful adoption.
4. Financial burden was perceived as high by small & medium facilities, while large facilities absorbed it better into their ongoing digitalisation budgets.

4.3 Technology infrastructure, IT effort, and interoperability

The journey differed by hospital size and setting, but was consistently described as an ongoing process, not a one-time technology upgrade.

Table 5: Technology Infrastructure, IT Effort, and Interoperability

LEVEL OF IT EFFORT AND TECHNICAL DEMAND

SMALL	MEDIUM	LARGE
• Very high due to low baseline maturity • Basic but critical technically • Vendor led	• High to moderate • Significant effort in system integration and training • Technically more demanding and mature, focus on integration	• High to moderate but structured • Strong IT teams • Technically highly complex and demanding, focus on optimization

CROSS-TIER INSIGHT: *Maturity doesn't mean less effort, but rather a shift in importance — growing from building basic set-ups to managing mature integrated systems.*

CAPABILITY TO ADDRESS THE CHANGES REQUIRED

SMALL	MEDIUM	LARGE
• Low to moderate capability • High dependence on vendors • Lean teams and resource constraints	• Moderate to high capability • Hybrid model: in-house + vendor dependence • Dedicated IT resources but still stretched	• High capability • Strong in-house IT teams and systems • Limited vendor dependence, typically for scaling up

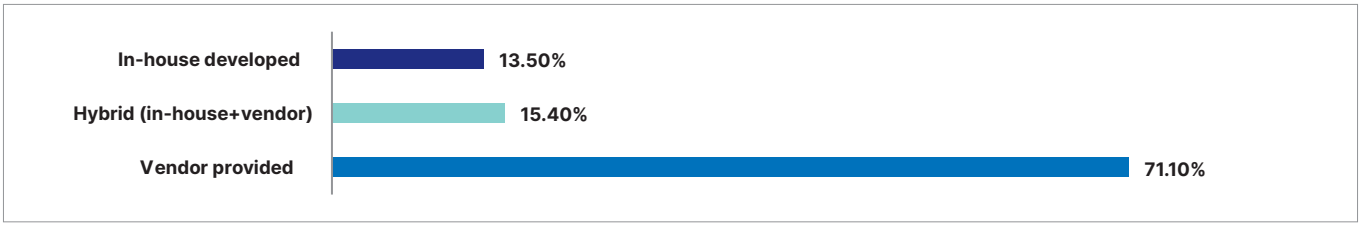
CROSS-TIER INSIGHT: *Vendor involvement remains important across all tiers, but its role becomes increasingly specialised.*

4.3.1 Level of IT Effort and Technical Demand

The findings indicate that DHS implementation requires substantial IT effort across all hospitals, with technical priorities evolving as digital maturity increases. With increase in digital maturity, effort shifts from implementation to integration and optimisation, rather than decreasing. Smaller hospitals focused on foundational capabilities such as HMIS/EMR implementation, digital records, infrastructure, security, and compliance. Medium-sized hospitals prioritised interoperability, workflow digitisation, and system integration, while large hospitals concentrated on optimisation through automation, cybersecurity, advanced analytics, enterprise-wide integration, and artificial intelligence. Across metro and non-metro settings, effort remains high, with maturity level influencing outcomes more than geography.

Majority of hospitals (71.10 %), across sizes and settings, relied on external vendors for their HIS and other systems. Even so, hospital IT teams remained central to the process, leading vendor coordination and technical implementation, gathering user feedback, and securing customisations suited to organizational needs.

Figure 13: HIS Model in use across hospitals



Across all hospital sizes and settings, clinical integration emerged as one of the most persistent technical challenges. Administrative systems were often relatively straightforward to connect, but integrating clinical workflows, documentation, diagnostics, and patient information across departments remained a chronic problem. Thus, as hospitals progressed along the digital continuum, the technical focus shifted from building systems to managing complex, interconnected systems.

4.3.2 Capability to address the changes required

While all hospitals recognised the need to strengthen their digital infrastructure, their ability to implement and sustain these changes varied considerably depending on the availability of internal IT expertise, dedicated resources, and access to external support. Across the interviews, participants rarely viewed technology as the main constraint. Instead, hospitals emphasised that successful implementation depended on building internal capability through skilled people, organisational learning, governance structures, and effective partnerships with technology providers.

Smaller hospitals relied heavily on external expertise to compensate for limited internal capacity, medium hospitals balanced internal and external capabilities through a collaborative model, while larger hospitals increasingly assumed ownership of digital transformation through stronger governance structures and dedicated digital teams.

This points to an important lesson from the DHS journey: **technology can be acquired relatively quickly,** but the **organisational capacity to use it effectively develops slowly,** through investment in people, processes, and institutional learning.

KEY TAKEAWAYS

1. IT effort remained high across all tiers, but shifted from setup (small hospitals) to integration (medium) and optimisation (large).
2. Vendor support was important across all hospital sizes, although dependence decreased as digital maturity increased.
3. The focus evolved from basic digital infrastructure to interoperability, automation, analytics, and real-time decision support.

4.4 Workflow Redesign and Clinical Usability

Within the thematic analysis, workflow redesign was among the most demanding changes, second only to training and behavioural change, and the paper-to-digital transition.

Table 6: Workflow redesign and clinical usability across hospital size

WORKFLOW REDESIGN AND CLINICAL USABILITY

SMALL	MEDIUM	LARGE
• Hybrid processes initially • Phased adoption to minimise disruption	• Siloed to integrated systems • Champions and peer motivation to drive adoption	• Greater structure and visibility over digital adoption

CROSS-TIER INSIGHT: *Clinical buy-in is the key driver; automation exists across sizes and geographical contexts.*

The level of workflow redesign required was inconsistent even within hospitals of the same size. Implementation was largely phased, especially in smaller hospitals, with some undergoing major workflow transformation, while others aligned and standardised existing practices. Hospitals that underwent deep restructuring shifted from paper-based or hybrid documentation to fully integrated, digital documentation and structured EMR workflows. Processes at small hospitals gained from access to single-click longitudinal patient history through Unique Health Identification (UHID), standardised templates, daily audits, and real-time data capture mechanisms such as bedside barcode scanners. To reduce errors, some hospitals used radio frequency-enabled (RFID) sample tags and allergy alerts.

> *"A Wi-Fi token is generated on a patient's mobile as soon as it connects to the hospital's network, removing the need for registration queues."*
>
> CEO · MEDIUM · PLATINUM · NON-METRO

Medium hospitals moved from loosely structured systems to sequential workflows. In some instances, automation was introduced to facilitate compliance to meet certification requirements: automated registration, Barcode Medication Administration (BCMA) and AI-enabled note-taking in OPDs.

Large hospitals generally had established workflows, though frontline adoption challenges persisted in high-volume settings. To support adoption and reduce documentation effort, some facilities introduced physician assistants and voice-to-text software. Real-time dashboards, visibility of edits and timestamps, audit trails, and consultant-specific templates became key enablers for uniformity in prescriptions and documentation practices. In chain hospitals, central leadership involvement enabled process standardisation and stronger cross-facility coordination, including sharing equipment and resources.

Adoption also placed demands on staff capabilities, and workflow redesign also had to account for digital skill gaps among staff, especially in tier-2 and tier-3 areas. The timing of digital adoption also varies department-wise. Generally, administrative workflows and OPD are the first to be digitalised, while IPD, ICU and other critical areas follow, except at a large, silver, non-metro, trust-funded facility, where the trend reverses owing to high patient volumes. This suggests that point-of-care alignment impacts documentation workflows.

To minimise resistance during implementation, many hospitals relied on a tiered model or peer recognition (designating early clinical adopters as "Digital Champions") to encourage wider adoption among colleagues. Significant effort, time, and budget investments are required to overcome this resistance, as according to the quantitative survey findings, staff training (84.6%) and workflow and process redesign (65.4%) emerge as the two most demanding effort areas.

> *"Our digital adoption hierarchy was three-tiered. Fist there were Master Users (core members: Quality Head, CEO and me); then Super Users (early adopters and department heads); and finally End Users (late adopters and senior clinicians)."*
>
> CLINICAL HEAD · MEDIUM · PLATINUM · METRO

Hospitals report transition to new or updated versions of HMIS, with EMR adoption being a key transformation area. Thematic analysis shows clinical workflows were most frequently redesigned, followed by discharge workflows, aligning with the 75% of respondents who reported faster reporting and discharge processing after certification. Billing and claims workflows were least redesigned, suggesting financial and procurement processes are perceived as harder to change. Workflow Redesign is mapped to NABH DHS chapter Care of Patients (COP) which governs safe and coordinated clinical care delivery; Discharge workflows is mapped to Access, Assessment and Continuity of Care (AAC) which covers patient entry, assessment, and continuity across departments; and Billing and claims workflows are mapped to Finance and Procurement Management (FPM) which governs financial planning, budgeting, and procurement processes, along with AAC.

Consent management remains largely paper-based owing to limited legal clarity surrounding digital consent in medico-legal cases, except for a medium, platinum, non-metro facility that devised an OTP-based consent mechanism, using a code sent to a relative's phone. Workflow redesign shows no clear variation by geography. As per the qualitative analysis, though non-metro hospitals frequently report compliance-driven adoption and persistence of hybrid documentation, some of the most advanced practices (AI-generated discharge summaries, automated quality reviews, OTP-based consent) are observed in non-metro facilities.

KEY TAKEAWAYS

1. Workflow redesign depth varied by hospital size: small hospitals leapt to nearly full EMR, medium hospitals integrated siloed systems, large hospitals focused on optimisation.
2. Staff training and process redesign are the top adoption barriers, tackled via tiered-adoption and peer-motivation models.
3. Clinical and discharge workflows saw the most redesign, finance the least.
4. Counter-intuitively, some of the most advanced innovations, AI discharge summaries, OTP consent, come from non-metro facilities.

4.5 Key Areas of Investment

Investment scale and structure vary somewhat with hospital size, but the progression is not strictly linear.

Table 7: Investment patterns across hospital size

AREAS OF INVESTMENT

SMALL	MEDIUM	LARGE
• IT infrastructure and software • Training and cybersecurity are major buckets	• Infrastructure readiness and expansion • Staffing, training, recurring costs rising	= Strategic IT expansion = Large-scale training drives

CROSS-TIER INSIGHT: *Same investment drivers apply across tiers, differing only in depth and scale.*

Early-stage investment centres on infrastructure upgradation, staff training, cybersecurity, and data storage; long-term investment shifts to annual maintenance and recurring training for new and existing staff. The thematic analysis corroborates: investments in software platforms and hardware infrastructure emerged as a key area of investment, with software upgrades standing out as the foremost priority. However, recruitment, capacity building, and cybersecurity infrastructure/controls were reported less frequently. The software platforms' theme aligns with DHS chapters Digital Operations Management (DOM), which sets standards for digital systems governing day-to-day operational workflows and processes across hospital departments, and Digital Infrastructure (DIS), which sets standards for the underlying IT infrastructure, systems, and network capabilities that support hospital digital operations. Recruitment and capacity building align with chapters Human Resource Management (HRM) outlines standards for staff recruitment, training, and competency development and IMS; hardware infrastructure as well as cybersecurity maps to DIS and DOM.

Small hospitals typically invest in basic infrastructure (HMIS: registration, billing, EMR, pharmacy, labs) to move from manual processes to digital systems. Some invest in advanced, niche-specific systems, such as a small, silver, metro IVF facility that uses an automated RFID system that flags sample mismatch.

Medium hospitals show two pathways: gradually adding functionality to existing systems (like small hospitals), or pivoting directly to advanced, integrated systems. A medium, platinum, non-metro facility built automated systems around its "specific pain points" to minimise revenue leakage and reduce recurring training needs. For frontline adoption, a medium, platinum, metro hospital invested in simulation-based HMIS induction training.

Large hospitals take a more strategic approach. Some stagger investment, while others make a large, one-time investment.

> *"Our recent hardware and software upgrade for DHS alignment cost nearly 1.2 crores, over 2.5× its 2017 spend, which was roughly 45 lakhs. We had to update our hardware/ computers to suit our new digital systems."*
>
> CFO · LARGE · SILVER · NON-METRO

Direct DHS costs at large setups are typically absorbed into existing accreditation or quality budgets rather than planned separately. Large hospitals also invest in tablets or computers-on-wheels for real-time IPD entry. Training investment here is substantial, like at a large, silver, non-metro hospital that ran a *"very ambitious Digital Lecture Project,"* using QR-based pre- and post-evaluations, shareable via WhatsApp, to cut per-session training time *"from 90 minutes to 45 minutes."* Larger hospitals also fund advanced functionality: AI-enabled discharge summaries, CRM-HIS integration, and patient navigation apps.

Metro investment skews toward staffing (overtime, hiring). Non-metro investment skews toward training, on top of infrastructure costs. Staff attrition in tier 2/3 cities adds to training costs. Across both contexts, chain hospitals everywhere benefit from centralised, better-absorbed budgeting.

> *"For DHS, we planned for a CIO position and hired new staff. Now there are 13 IT staff members. Earlier, there was only a manager position, and two people in IT team."*
>
> VP, GROWTH AND STRATEGY · MEDIUM · GOLD · METRO

KEY TAKEAWAYS

1. Investment depth scales with size: small hospitals build basic HMIS, medium hospitals split between incremental upgrades and targeted fixes, large hospitals treat it as a strategic investment.
2. Investment starts with infrastructure and systemupgradation; AMC/CMC and training are ngoing investments.
3. Software upgrades remain the primary investment priority, complemented by hardware enhancements and the deployment of point-of-care technologies such as Computers-on-Wheels (CoWs) and bedside tablets.
4. Metro hospitals skew toward staffing spend, non-metro toward training due to high attrition.

4.6 Post-Certification Value and Outcomes

This section examines the value hospitals realised after DHS certification across five outcome areas: clinical quality and patient safety; operational efficiency and workflows; resource and financial efficiency; governance and compliance; and digital maturity and cybersecurity.

Table 8: Post certification value and outcomes by hospital size

CLINICAL QUALITY AND PATIENT SAFETY

SMALL	MEDIUM	LARGE
• Reduced medication errors • Improved patients safety	• Structured clinical documentation • Improved interdepartmental coordination	• Reduced medication errors • Data-driven clinical governance

CROSS-TIER INSIGHT: *Improved patient safety through real-time monitoring of medication dispensing and administration.*

OPERATIONAL EFFICIENCY AND WORKFLOWS

SMALL

- Shift from paper-based to digital workflows for billing, discharges and registration
- Reliance on manual backup systems during downtime

MEDIUM

- Improved billing efficiency
- Advanced tools for registration and discharge processes

LARGE

- Advanced tech for discharge summaries and death certificates
- Real-time dashboards remove need for physical follow-up

CROSS-TIER INSIGHT: *Discharge/registration times improved, but mature pre-DHS hospitals saw no significant wait-time gains; clinical adoption gaps limit operational gains.*

FINANCIAL EFFICIENCY

SMALL

- Financial investment disproportionate to size
- Investments phased rather than upfront

MEDIUM

- Faster claims processing, low rejection rates
- Significant increase in post-adoption IT budgets

LARGE

- No specific budget for DHS, absorbed within broader digitalisation costs

CROSS-TIER INSIGHT: *Investment-to-return ratio unclear, too early to measure; considerable gains in billing efficiency and revenue leakage control.*

GOVERNANCE AND COMPLIANCE

SMALL

- DHS surfaces hidden governance gaps, enables structured data repositories
- Governance remains operationally embedded, not formal committees

MEDIUM

- DHS formalizes and standardizes existing systems
- Compliance monitoring concentrated in quality/IT, not dept. heads

LARGE

- Visible governance gains: role-based access, audit trails, real-time dashboards
- DHS standardizes what exists rather than driving new infrastructure

CROSS-TIER INSIGHT: *Full ABDM integration not yet a priority, ABHA ID generation is the common first step; shift from audit-driven to continuously embedded compliance.*

DIGITAL MATURITY AND CYBERSECURITY

SMALL

- Shift from siloed, fragmented systems to more integrated systems
- Vendor-dependent systems limit facility-level control

MEDIUM

- Maturity defined by actual usage, not system availability

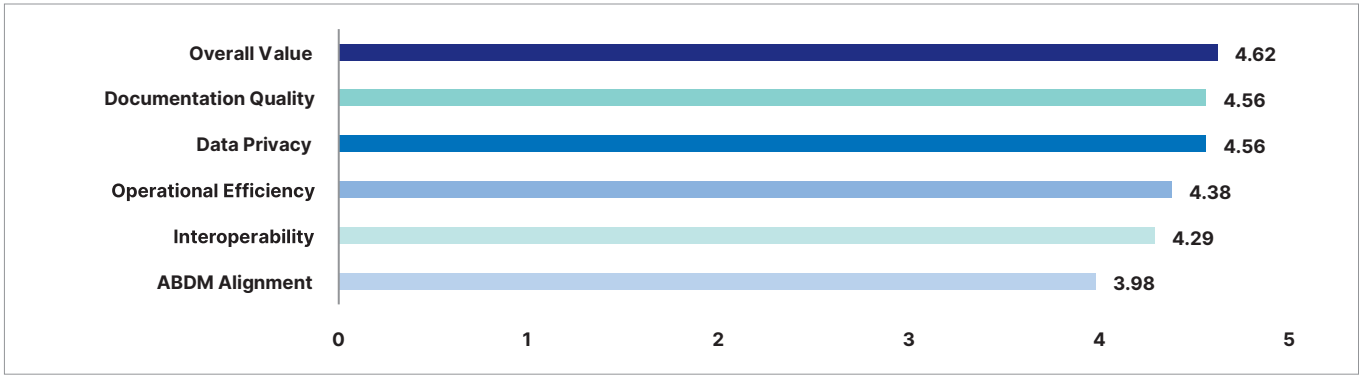
LARGE

- Data more traceable/accessible, better visibility across user-levels
- SSO across modules is the most technically demanding DHS requirement

CROSS-TIER INSIGHT: *Cybersecurity consistently underestimated and reactively addressed.*

Respondents rated six dimensions of perceived post-DHS outcomes on a 5-point scale. Overall, value received the highest mean rating (M = 4.62), closely followed by Data Privacy and Documentation Quality (both M = 4.56). Operational Efficiency (M = 4.38) and Interoperability (M = 4.29) were rated somewhat lower, while ABDM Alignment received the lowest rating by a clear margin (M = 3.98).

Figure 14: Post DHS outcome perceptions (mean 1-5)



Hospitals that reported greater organisational effort in DHS implementation reported better outcomes across nearly every dimension measured. Quantitative analysis of survey responses found that higher reported effort was significantly associated with stronger perceived gains in operational efficiency, documentation quality, overall value, data privacy, and interoperability. The one exception was ABDM alignment, where reported effort level made no significant difference - potentially aligning with the qualitative finding that readiness for national digital health integration depends less on how hard a hospital works during DHS implementation and more on whether it has made the underlying infrastructure decisions.

4.6.1 Clinical Quality and Patient Safety

Clinical quality and patient safety gains - stronger medication safety, documentation accuracy, and clinical traceability - appear consistently across hospital sizes, though their depth tracks closely with the extent of clinical adoption, which remains incomplete in most settings. Across all sizes, the principal negative outcome is increased documentation burden during the transition phase, compounded in hybrid settings by dual paper-and-digital entry. The most consistent structural shift is the move from sequential, file-based coordination to parallel, real-time workflows. Nursing has absorbed the bulk of this transformation, including new support roles created to offset slower clinician adoption.

> “After the software was updated, nurses found it difficult to enter data every shift into the system. They had extra burden and required extra training and effort. Main pressure of maintaining compliance always falls on frontline users.”
>
> NURSING SUPERINTENDENT · MEDIUM · SILVER · NON-METRO

Quantitatively, approximately 98% of surveyed hospitals cited patient safety improvement as a primary motivation for pursuing DHS certification. Notably, geography does not meaningfully differentiate these outcomes: clinician resistance to documentation is universal, and leadership commitment proves a stronger predictor of clinical quality gains than location.

Small hospitals see the most visible gains, largely from eliminating handwriting-related errors, misread prescriptions, ambiguous dosages, and missed allergy flags - through digital dispensing records, barcode-based medication administration, and automated lab-to-clinician result linkage.

Medium hospitals show more systemic gains: real-time timestamping, mandatory structured fields for vitals and allergy history, and improved interdepartmental coordination. These gains are constrained by uneven EMR adoption, with documentation often remaining nursing-led.

> *"Medication error with OPD prescription has come down; that used to be the biggest challenge."*
>
> CLINICAL · MEDIUM · PLATINUM · METRO

Large hospitals having already addressed foundational error prevention, see gains concentrated in governance and advanced safety functionality: prescription standardisation across large consultant teams, system-level safety nets (LASA alerts, drug-interaction warnings, dose enforcement), and data-driven clinical governance.

4.6.2 Operational Efficiency and Workflows

Operational efficiency is the most consistent and measurable outcome of DHS adoption, with gains concentrated in registration and admission, discharge turnaround, billing and revenue cycle, and interdepartmental coordination, though the magnitude varies by baseline digital maturity. Across all sizes, discharge turnaround reduction is the most consistently cited tangible gain, alongside registration efficiency, stronger interdepartmental coordination, and improved billing accuracy.

> *"Discharge used to be more than one hour; now goes hardly up to 15 to 20 minutes."*
>
> QUALITY · SMALL · GOLD · NON-METRO

Some hospitals report that the operational gains support capacity expansion, without requiring any new recruitments or hiring. Beyond measurable process gains, stakeholders describe a durable shift from people-dependent to system-dependent operations. Combined with data-driven management through live dashboards, this shift allows processes to survive leadership changes and staff turnover in a way they couldn't before.

> *"Operational efficiency per patient improved which enabled the hospital to handle increased footfall from approximately 4,000 patients per month to 7,000 without proportional staff increase."*
>
> OPERATIONS HEAD · SMALL · PLATINUM · NON-METRO

> *"When a head changes, processes usually change. But now no one can change the system; adoption is already done and improvements can only happen on top of it."*
>
> COO · MEDIUM · SILVER · NON-METRO

The main gap is a temporary rise in operational cost during the transition phase, as low physician EMR adoption continues to limit how far efficiency gains extend, even where system capability is strong. Geographic variation is minimal; accreditation tier is a stronger predictor of gains than location.

Small hospitals see the most immediate gains, since the shift from paper-based or hybrid workflows to integrated systems is largest here: registration times have fallen sharply. That said, recently certified hospitals say it's still too early to assess full impact, and limited backup infrastructure leaves smaller setups vulnerable to billing disruption during system downtime.

> *"Reduced turnaround time, less manual processes, manual duplications, clerical mistakes, system optimizations, no illegibility issues — these are all substantial pros."*
>
> OPERATIONS HEAD · SMALL · SILVER · METRO

Medium hospitals report faster registration through QR/app-based self-registration, auto-generated discharge summaries, and a shift from post-billing to pre-billing (from after test/procedures to billing in advance) that improves revenue accuracy, though this pattern isn't uniform across the tier.

Large hospitals see gains expressed more through governance and real-time visibility than raw process speed, since foundational digitalisation predated DHS. Discharge times fell by roughly 50% at one hospital through parallel departmental processing, while billing completion time and claims rejection rates improved sharply through automated charge capture .

> *"Earlier, it (discharge time) used to be 4 hours, it has come down to less than two hours."*
>
> OPERATIONS HEAD · LARGE · SILVER · NON-METRO

4.6.3 Financial Efficiency

Financial returns from DHS remain the most contested outcome area, constrained by an attribution problem: costs are immediate, but returns are indirect, delayed, and difficult to separate from broader digitisation already underway; DHS functions more as a validation layer on existing digital investment than as its trigger. Where gains are visible, they follow a size gradient: small hospitals face the most genuine financial strain, given the disproportionate burden relative to facility size. Medium hospitals show emerging but uneven returns, with gains in leakage reduction (33% to 7% in one case), stationery savings, and digital outreach channels.

Large hospitals see returns framed around governance, cost and leakage control rather than new revenue. The common constraint across tiers is that ROI stays intangible wherever adoption lags .

> *"Digitization has led to 15% of our revenue coming from digital marketing."*
>
> CFO · MEDIUM· GOLD · METRO

4.6.4 Governance and Compliance

Governance and compliance outcomes determine whether DHS gains are sustained rather than one-off. Across the cohort, DHS shifts hospitals from audit-driven, staff-dependent compliance toward continuously monitored governance - daily reviews, defined data-accuracy ownership, and system-generated documentation, though the model remains fragile, as monitoring still sits with quality and IT teams rather than being distributed to department heads and clinical staff. Notably, governance gains hold consistently across metro and non-metro hospitals alike, variation is driven more by hospital maturity and leadership commitment than by location.

> *"The leakage control post-DHS alone justifies a ₹1.2 crore system investment we made."*
>
> CFO · LARGE· SILVER · NON-METRO

These findings are echoed in the thematic analysis, with most respondents describing realised value in improved interdepartmental coordination, closely followed by improvements in documentation completeness and compliance monitoring. The interdepartmental coordination theme aligns with the AAC and COP chapters, while documentation completeness aligns with Information Management Systems (IMS) governing standards for hospital-wide information management, including data security and record-keeping, alongside AAC and COP.

Small hospitals show the most visible transformation under DHS. Many started with fragmented, vendor-dependent systems. In some cases, vendors themselves didn't know DHS standards and had to learn them through the hospital. DHS pushed these hospitals toward structured digital documentation, though governance relies on daily IT oversight and vendor support rather than formal committees or dashboards. The governance value can extend beyond compliance into research and academic capability.

> *"DHS enabled data structuring. This helped us build a repository we use for clinical research. We are doing a study on typhoid now."*
>
> CEO · SMALL· SILVER · NON-METRO

Medium hospitals show more structured governance, daily data reviews, defined roles for data capture, and issue logs that track recurring problems. DHS also plays a distinct role in vendor selection, amid a market full of unverified paperless system claims. ABDM progress at this tier is mixed; some hospitals have achieved basic interoperability, while others are citing data-security concerns for not pursuing ABDM.

> *"When we started our digital journey, we found many vendors who claimed to have paperless systems but didn't deliver on our requirements. We wanted a benchmark against which to weigh a good vendor. DHS gave us that."*
>
> CEO · MEDIUM · PLATINUM · METRO

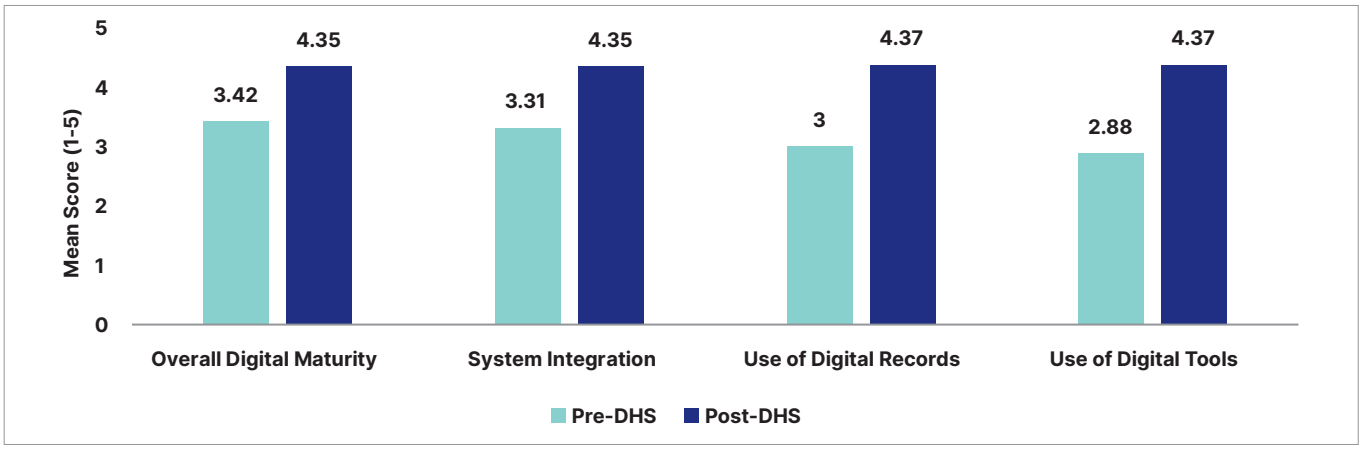
Large hospitals report the most mature governance - role-based access, non-editable audit trails, centralised cross-department control, valuing DHS more for standardisation and data portability than operational gains, with the most advanced ABDM integration in the cohort (one facility reaching M3-level, hospital-wide interoperability). Chain hospitals use DHS primarily to standardise and scale across units, gaining remote, centralised visibility.

4.6.5 Digital Maturity and Cybersecurity

Digital maturity and cybersecurity impact every other DHS-driven gain. Networking investments - redundant connectivity, MPLS links, cloud-based backup increasingly underpin this maturity, though single-point connectivity failures remain a live risk at smaller and some medium facilities. Cybersecurity is the area most consistently addressed reactively: investment typically follows DHS preparation. Other unresolved gaps persist across the cohort: integration of Windows-based diagnostic equipment (endoscopy, ultrasound) with HMIS remains a vendor-level limitation with no current solution, data storage costs are consistently underestimated, smaller hospitals often face vendor capability gaps, and the DPDP Act is acknowledged but not yet operationalised.

According to the quantitative survey, digital maturity improved markedly post-certification as depicted in the figure below.

Figure 15: Pre vs post digital maturity



Small hospitals show the most dramatic transformation, given the lowest starting point. Network infrastructure is the most demanding gap; one hospital had to rewire its entire building to eliminate dead zones. Data backup, OTP-based login, and encrypted access are often addressed here for the first time, and multi-vendor interoperability remains a slow, phased process. At the more advanced end of this tier, a small, silver, non-metro hospital shows what is achievable through deliberate design: deploying a mobile-first, barcode-enabled EMR and removing paper alternatives entirely, reflecting a strategy in which behavioural change was driven by eliminating the option to revert.

Medium hospitals reveal that digital maturity is less about having systems in place and more about how well those systems work together in practice. Several hospitals had to upgrade to multiple backup internet connections before reliable digital workflows were even possible. Hidden technical debt duplicated service names; inconsistent master data surfaced only during DHS preparation, requiring cleanup before integration could proceed. Cybersecurity followed the same reactive pattern; with firewalls and access controls added after gaps were identified rather than upfront.

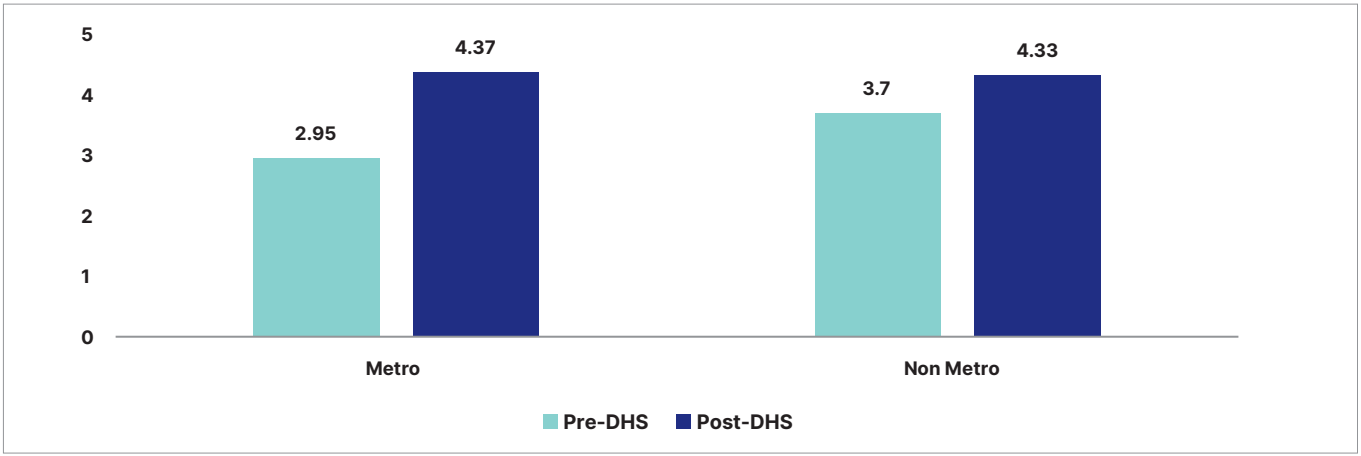
> *"The hospital realized that digital maturity was not merely about system availability, but about actual usage and integration into clinical practice."*
>
> CIO · MEDIUM · PLATINUM · METRO

Large hospitals see maturity gains concentrated in backend integration complexity, with Single Sign-On across all modules cited as the most technically demanding DHS requirement. Cybersecurity governance is most mature here, though still strengthened further during DHS. Chain hospitals

benefit from centralised corporate IT support, reporting 90-98% compliance post-certification with lower per-unit burden.

Qualitative interviews show no meaningful difference. Cybersecurity underestimation and reactive investment appear equally across both metro/non-metro contexts. But the quantitative data tells a more nuanced story: metro hospitals started from a notably lower baseline and saw roughly double the gains of non-metro hospitals across all dimensions, with both groups converging to a similar endline maturity.

Figure 16: Pre vs post digital maturity across geography



This is likely explained by response-shift bias (Howard, 1980) - non-metro hospitals benchmarking against fewer advanced peers, inflating self-assessed baselines combined with a ceiling effect (Staus et al., 2021), rather than any true geographic advantage. Additionally, the leapfrogging effect ("advantage of backwardness," Montias, 1963) lets non-metro hospitals move directly from paper-based processes to modern platforms while metro hospitals navigated more complex legacy transitions. In short: accreditation tier and prior investment history are stronger predictors of digital maturity than location.

KEY TAKEAWAYS

1. Gains are consistent in direction but vary in depth by hospital size, baseline digital maturity, and leadership intent.
2. Operational efficiency and governance show the most consistent, measurable gains, while financial returns remain the most contested outcome.
3. Clinical quality and patient safety gains appear across all hospital sizes, but their depth tracks the extent of clinical adoption, which still lags in IPD, OT, and ICU settings relative to OPD.
4. Digital maturity rose sharply post-certification, yet cybersecurity investment remains largely reactive to DHS.
5. Hospitals that invested more effort in implementation saw stronger gains across nearly every dimension measured. ABDM alignment varied with the organisation's strategic priorities.

4.7 Sustainability of Adoption and Compliance Mechanism

As hospitals progress in their digital maturity journey, the mechanisms used to sustain DHS adoption and maintain compliance become increasingly structured and system enabled.

Table 9: Sustainability of Adoption and Compliance Mechanism across hospital size

SUSTAINABILITY OF ADOPTION AND COMPLIANCE MECHANISMS

SMALL	MEDIUM	LARGE
• Sustainability audit-driven and weakly embedded • Compliance monitored through manual checks • Basic HIS/EMR systems used for data entry • Adoption relies on leadership oversight and individual accountability	• Sustainability via regular reviews, audits, and dashboard-based tracking • Compliance still requires continuous nudging and follow-up • Systems support monitoring but do not consistently drive behaviour • Adoption only partially embedded	• Sustainability through real-time dashboards, alerts, audit logs, and automated triggers • Compliance proactively supported by quality, operations, and CIO/IT teams • Behavioural adoption uneven, particularly within clinical workflows

CROSS-TIER INSIGHT: *Sustainability remains strongest in standardized administrative functions and weakest in clinical workflows.*

For smaller hospitals, external requirements and leadership monitoring largely drove compliance rather than deeply embedded practices. Sustainability of digital systems was strongest around accreditation cycles and audit periods. Monitoring mechanisms were typically manual and reactive, with issues identified during reviews or after errors had already occurred.

As hospitals grew in size and digital maturity, compliance increasingly became part of routine operational management rather than something driven solely by audits. In medium-sized hospitals, regular audits, compliance reports, supervisory reviews, and departmental monitoring mechanisms became more common, helping organisations identify and address gaps more systematically. Quality teams often played a central role in coordinating these activities and maintaining attention on compliance indicators. Compliance had become part of routine operations, but it was not yet fully self-sustaining.

In larger hospitals, the focus shifted from establishing compliance structures to ensuring sustained adoption through governance mechanisms, real-time monitoring, and system-led accountability. Monitoring became more proactive, supported by dashboards, automated alerts, audit logs, exception reports, and real-time tracking systems that provided continuous visibility into performance indicators. Compliance was reinforced through a combination of quality teams, operations leaders, and CIO or IT departments working together to monitor performance and address gaps. For example, clinicians could not proceed with certain processes unless they completed mandatory documentation, while audit logs allowed hospitals to identify incomplete records, delayed entries, or users bypassing expected workflows.

Across all hospital types, administrative, billing, and laboratory functions consistently demonstrated stronger compliance because workflows in these areas were standardised, measurable, and easier to monitor. Hospitals frequently highlighted examples such as automatic transfer of physician orders to billing systems, digital laboratory workflows, and electronic tracking of investigations, where

process completion could be readily verified through the system. Their direct links to operational efficiency and revenue generation also created strong incentives for adherence.

In contrast, clinical workflows including physician documentation, medication orders, nursing records, ICU processes, and operating theatre documentation remained the most difficult areas to achieve sustained compliance. These workflows were more complex, highly dependent on clinician behaviour, and often occurred in time-sensitive environments where patient care understandably took precedence over documentation. Consequently, even hospitals with advanced governance structures and sophisticated monitoring systems continued to face challenges in ensuring consistent system use at the point of care.

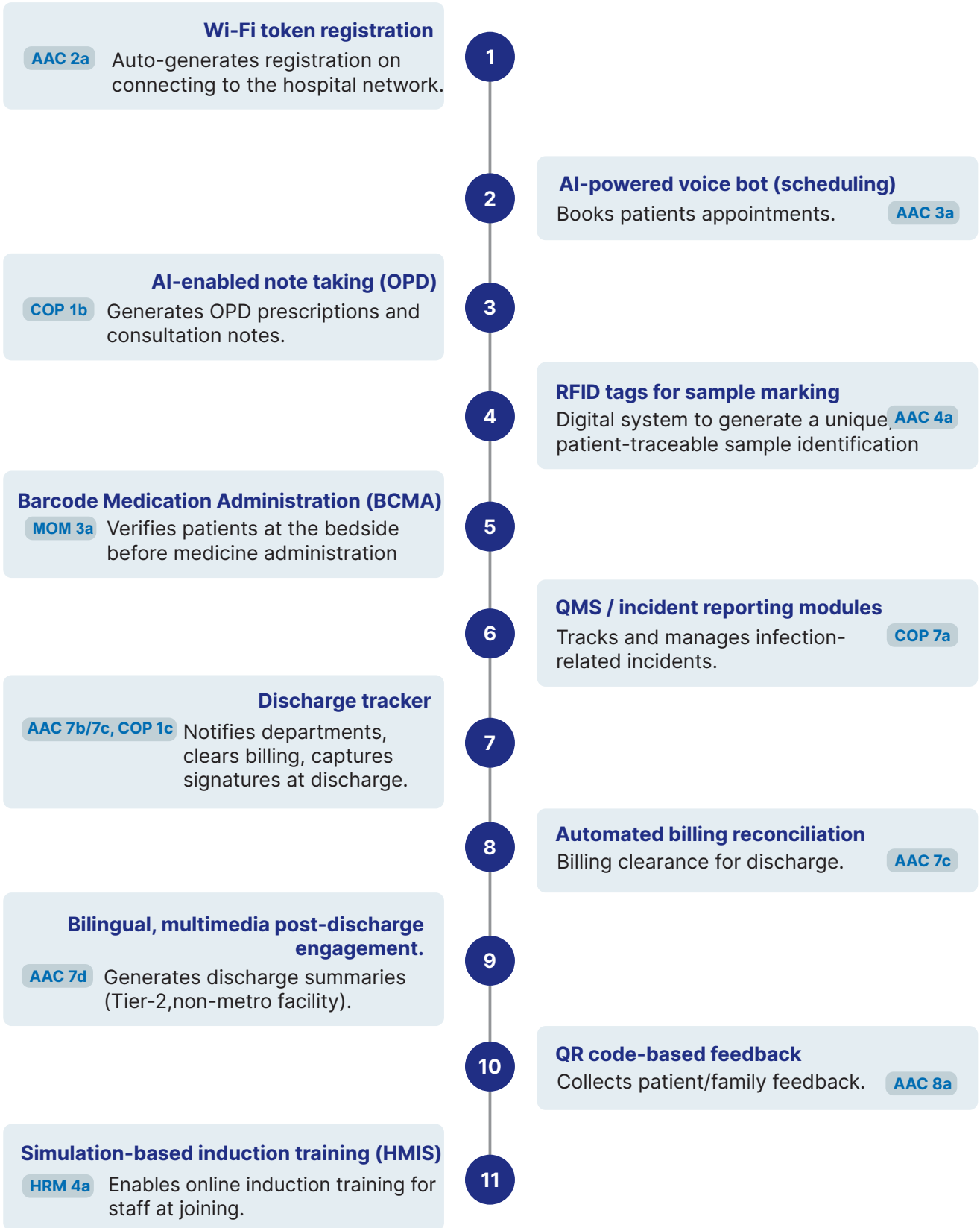
KEY TAKEAWAYS

1. Compliance becomes more structured as hospitals become more digitally mature.
2. Sustained adoption depends on clinicians consistently using and trusting the system.
3. Administrative functions show higher compliance than clinical workflows.

5 Translating Innovations to DHS Compliance

Several hospitals invested in advanced innovations to make the process of care delivery efficient and patient friendly. The figure below maps each innovation to its corresponding chapter and objective element, illustrating how technology adoption translates into measurable standard fulfilment.

Figure 17: Innovations mapped to DHS objective elements

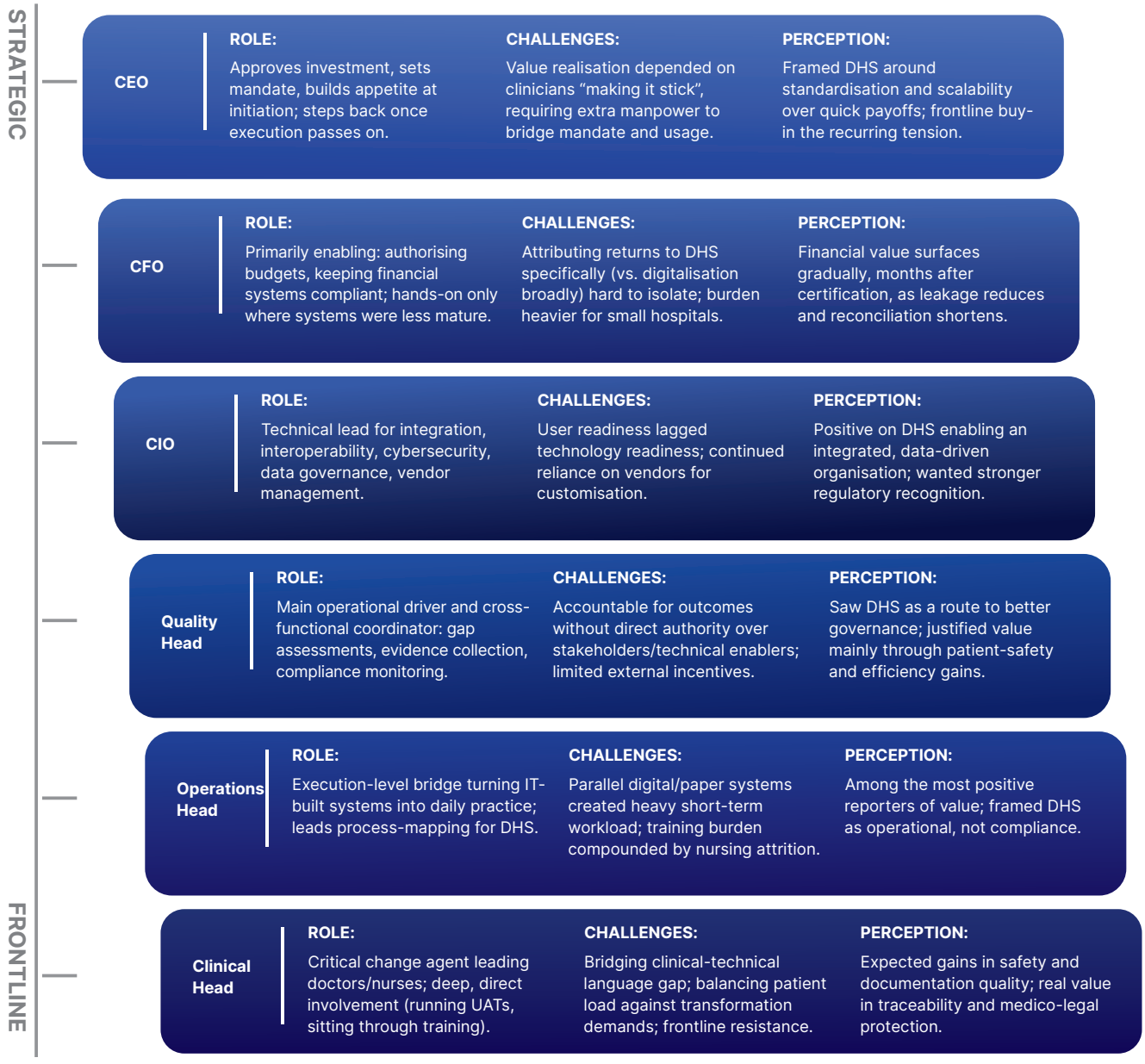


6 Comparative Analysis of Stakeholders' Perspectives

Diverse stakeholders shaped the DHS journey in different ways, from strategic sponsorship and resource allocation to implementation, adoption, and ongoing compliance. While all stakeholders contributed to DHS outcomes, their roles, expectations, and experiences varied significantly based on their position in the organisation and the extent of their involvement in digital transformation efforts.

This section examines six key stakeholders, including CEO/Hospital Leadership, CFO, CIO, Clinical Head, Quality Head, and Operations Head, across five dimensions: level of involvement, primary role in the DHS journey, interests and expectations, experience of value, and tensions and limitations. Drawing exclusively from the qualitative interviews, it highlights not only common patterns but also notable variations, outlier experiences, and stakeholder-specific perspectives on what drove or constrained the realisation of value from DHS.

Figure 18: Role- based analysis of stakeholders' perspectives



7 Challenges and Reflections

This section presents broader reflections from stakeholder interactions during the study, highlighting key challenges, observations, and areas for refinement.

The tiered Silver, Gold, and Platinum structure helped hospitals at different readiness levels to engage with DHS, though some felt it doesn't sufficiently distinguish those who meet the standard from those who exceed it. Optional recognition in areas like clinical adoption or compliance sustainability could reward higher maturity without raising barriers for resource-constrained hospitals.

Small and speciality hospitals faced greater implementation challenges, pointing to a need for cost support and phased incentives for this group. Some of the early adopting hospitals flagged a technical glitch/ administrative delay on the NABH digital portal. NABH's largely online staff training was seen as inadequate, especially in tier 2/3 settings; hospitals called for in-person training, vernacular content, and recurrent refreshers rather than one-time programmes. Relatedly, the lack of patient education material and staff training in local languages creates communication barriers, a gap hospitals can address for effective engagement.

Consent management remains largely paper-based due to legal ambiguity surrounding digital consent in medico-legal cases in India. Wider adoption will require regulatory clarity, backed by sustained policy advocacy from bodies such as NABH and the National Health Authority.

Figure 19: Gaps, challenges and reflections

"DHS works best when it meets hospitals where they start, not as a uniform bar for diverse facilities."

GAPS AND CHALLENGES

Training format: online-only doesn't fit tier 2/3 staff; needs in-person, vernacular, refresher-based delivery

Implementation burden: falls hardest on small/specialty hospitals; chain-affiliated hospitals have a structural edge

REFLECTIONS

Certification tiers: one-size-fits-all overlooks nuanced contexts; introduce optional recognition in specific areas

Consent: still largely paper-based; requires sustained policy advocacy

8 Conclusion

Across the sample, hospitals reported clear gains in patient safety and clinical quality, operational efficiency, documentation standardisation, and data-driven governance. These gains deepened with the extent of clinical adoption and effort invested, with DHS functioning as a catalyst for digital advancement.

Across the 20 hospitals studied, the certification journey was consistently experienced as substantial but worthwhile organisational work. Aligning with DHS still meant real effort: staff training and behavioural change, workflow redesign, system integration, and customising vendor systems, with smaller and speciality hospitals facing the most demanding transition given fewer resources. Even so, hospitals largely viewed the certification as valuable and meaningful: adoption was leadership-driven, with stakeholders supporting the process through to completion and vouch for the value the standards add to everyday processes, strengthening patient safety.

India's hospitals are rapidly digitalising amid a wider national shift led by the Ayushman Bharat Digital Mission, and DHS has become the framework that drives this movement by translating scattered, hospital-led efforts into a common, benchmarked standard that hospitals, patients, and policymakers can all measure against. As India's healthcare ecosystem progresses toward a more connected, accountable health system, DHS is positioned as a meaningful marker of digital maturity, grounded in the real gains hospitals have already begun to realise.

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Appendix

Mapping of Objective Elements (OEs) to Qualitative Themes

The following objective elements (OEs) were mapped to thematic findings based on recurring patterns identified through qualitative interviews and thematic analysis.

Most Demanding Change

COP.1.b
Digital system for OPD prescriptions and consultation notes
COP.1.f
Digital system for computerized provider order entry (CPOE) for medicines
COP.2.a
Digital system for inpatient nursing notes
HRM.4.a
Provision for online induction training for staff
HRM.4.b
Digital mechanisms for periodic in-service staff training

Key Gaps

COP.1.b
Digital system enables OPD prescriptions and consultation notes
AAC.2.g
Capability to link all patient records to a unique patient identifier
AAC.4.c
Auto-population of laboratory results through system integration
IMS.1.a
Creation of health documents in interoperable formats
IMS.1.j
Digital system ensures mandatory fields are identified and completed in patient records
IMS.1.j
Digital system accepts field values only in predefined formats
IMS.1.k
Digital system defines templates for clinical and non-clinical documentation
IMS.2.g
HIMS capable of interfacing with third-party applications
HRM.4.a
Provision for online induction training for staff
HRM.4.b
Digital mechanisms for periodic in-service staff training
HRM.4.d
Digital system to maintain staff training records

Clinical Workflows

COP.1.a
The OPD initial assessment and patient progress is recorded on a digital system by the nurses
COP.1.b
The hospital uses a digital system for treating medical practitioner to create OPD prescriptions and consultation notes
COP.1.d
The hospital uses a digital system for treating medical practitioners to create CPOE for laboratory tests and procedures
COP.1.e
The hospital uses a digital system for treating medical practitioners to create CPOE for radiology tests and procedures
COP.1.f
The hospital uses a digital system for treating medical practitioners to create CPOE for medicines
COP.2.a
The hospital uses a digital system for nurses to create Inpatient nursing notes
COP.2.b
The hospital uses a digital system to manage and record nursing care plans for IPD patients
COP.5.f
The hospital uses a digital system to record surgical procedures / interventions undertaken

Billing and Claims

AAC.7.c
The hospital uses a digital system for their billing department to give clearance for patient discharge
FPM.2.a
The hospital uses a digital payment channel to make vendor payments
FPM.2.b
The hospital uses a digital system to maintain records of all payables and receivables
FPM.3.a
The hospital uses a digital system for patients to pay for availing any hospital services
FPM.3.b
The hospital uses a digital system that includes pre-defined charges for all key services and items
FPM.3.c
The hospital uses a digital portal for patient and/or family member to view provisional / final bills
FPM.3.d
The hospital uses a digital mechanism to periodically update the patient on their billing records
FPM.3.e
The hospital uses a digital standardized billing template
FPM.3.f
The hospital uses a digital system to manage insurance claims
FPM.3.g
The hospital uses a digital mechanism to notify and update about the TPA / insurance / empaneled agencies process(es)
FPM.3.h
The hospital uses a digital system to route its claim through Health Claims Exchange (HCE)

Discharge Workflows

AAC.7.a
The hospital uses a digital system through which the primary treating medical practitioner can request and update their patient's discharge information.

AAC.7.b
The hospital uses a digital notification to communicate patient details, when due for discharge, with other internal departments.

AAC.7.c
The hospital uses a digital system for their billing department to give clearance for patient discharge.

AAC.7.d
The hospital uses a digital system through which the treating medical practitioner is able to generate patient's discharge summary.

AAC.7.e
The patient's discharge summary is linked to their ABHA address and part of their longitudinal health record.

AAC.7.f
The hospital uses a digital system to manage inter-departmental patient transfers in the hospital.

Improved Interdepartmental Coordination

AAC.2.g
The hospital uses a digital system that has the capability to link all patient medical records (generated at any patient touch point within the hospital or during any of the visits) to their unique patient identification.

AAC.7.b
The hospital uses a digital notification to communicate patient details, when due for discharge, with other internal departments.

AAC.7.f
The hospital uses a digital system to manage inter-departmental patient transfers in the hospital.

COP.1.d
The hospital uses a digital system for treating medical practitioners to create computerized provider order entry (CPOE) for laboratory tests and procedures.

COP.1.e
The hospital uses a digital system for treating medical practitioners to create computerized provider order entry (CPOE) for radiology tests and procedures.

COP.1.f
The hospital uses a digital system for treating medical practitioners to create computerized provider order entry (CPOE) for medicines.

Compliance Monitoring

IMS.2.d
The hospital uses a digital dashboard to measure the quality-of-care delivery.

DOM.3.d
The hospital periodically conducts IT audits internally to confirm no major vulnerabilities.

DIS.2.d
The hospital uses a digital system that captures the audit trails of each transaction.

DOM.2.c
The hospital uses a digital system to monitor the performance of different healthcare applications.

Recruitment and Capacity Building

HRM.2.a
The hospital uses a digital system that is integrated with external job posting websites.

HRM.2.b
The hospital uses a digital system to track and manage internal employee referrals for staff.

HRM.2.c
The hospital uses a digital system to manage employee resignation and related process. Auto notifications are triggered to various concerned departments through this system.

HRM.4.a
The hospital has a provision of conducting online induction training for staff at the time of joining the hospital.

HRM.4.b
In addition to traditional means of learning and training, the hospital deploys digital means to provide periodic in-service trainings to the staff, wherever feasible.

IMS.2.a
The hospital has a designated IT team to manage digital operations.

Hardware Infrastructure

DIS.1.a
The hospital uses a digital system that supports accessibility of Uniform Resource Locator (URL) on all kinds of devices whether tablet, mobile device, desktop etc.

DIS.1.c
The hospital provides treating medical practitioners with electronic devices to access electronic health records of patients.

DIS.1.d
The hospital's allied services staff members are equipped with adequate electronic devices to access the hospital's administrative applications.

DIS.1.e
The hospital ensures that backup is available for internal network.

DIS.1.f
The hospital uses a power backup for their digital systems.

DIS.1.h
The hospital uses a digital system that is largely deployed on cloud-based solutions rather than hosted on on-premises solutions.

DIS.1.i
The hospital staff uses mobile devices rather than fixed devices to access hospital's digital system.

DOM.3.a
The hospital uses a digital system to manage inventory record of all IT assets.

Cybersecurity Infrastructure/Controls

DIS.2.a
The hospital uses digital means to ensure that their data is encrypted.

DIS.2.b
The hospital uses an active/valid anti-virus to prevent, detect, and remove malware for hospital applications.

DIS.2.c
The hospital uses a firewall that monitors incoming and outgoing network traffic.

DIS.2.d
The hospital uses a digital system that captures the audit trails of each transaction.

DIS.2.e
The hospital uses a digital mechanism to allow secure access of hospital's data through remote location.

DOM.4.a
The hospital uses a disaster recovery plan to manage patient healthcare records in case of an unforeseen circumstance.

DOM.4.b
The hospital uses a disaster recovery plan to manage administrative applications (i.e., applications that support health-related systems) in case of an unforeseen circumstance.

DOM.5.a
The hospital uses a digital system to manage end-user credential and authentication.

DOM.5.b
The hospital uses a digital system that provides two factor authentication for all IT systems.

DOM.5.c
The hospital uses a digital mechanism to protect and restrict data transfer on external storage devices.

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