

Digital Operating Room Integration for Safer Surgical Care

Category: Digital Excellence

Focus Area: Implementation and effective use of Clinical Applications

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Problem Statement / Digital Challenge

Prior to digital transformation, PSG Hospital's operating rooms functioned with fragmented audiovisual (AV) infrastructure, resulting in inconsistent workflows across 21 operating theatres. There was no centralized platform for live streaming, surgical video recording, content management, or real-time collaboration. Surgical procedures were documented using disparate systems, making it difficult to archive, retrieve, review, and securely share operative videos for clinical decision-making, quality audits, and academic purposes. The lack of integration also limited remote consultations, multidisciplinary discussions, and medical education while creating challenges in complying with NABH Digital Health Standards.

A comprehensive digital solution was required to establish a fully integrated Operating Room ecosystem with seamless connectivity between ORs, PACS, HIS/EMR, DICOM imaging, and learning platforms. The objective was to standardize surgical workflows, improve interoperability, enhance patient safety, strengthen clinical documentation, and enable secure digital access to surgical information while maintaining sterile operating environments.

The initiative primarily impacted surgeons, anesthetists, OT technicians, nursing staff, hospital administrators, medical students, and patients. Surgeons required efficient access to imaging, recording, and collaboration tools; nursing and OT

teams benefited from simplified workflows with minimal equipment handling;

administrators gained better governance, traceability, and operational efficiency; educators and students obtained structured access to live and recorded surgeries; and patients benefited from enhanced safety, reduced OR crowding, and complete digital documentation.

The project directly strengthened NABH quality indicators related to Patient Safety, Clinical Documentation, Information Management System (IMS), Continuity of Care (COP), Access and Assessment (AAC), Digital Traceability, Infection Prevention, Education & Training, and overall operational efficiency.

Digital Tool / Solution Implemented

PSG Hospitals implemented a comprehensive Digital Operating Room (OR) Integration Platform across 21 operating rooms through an outsourced solution delivered by Esbee Dynamed. The platform integrates audiovisual (AV) routing, high-definition surgical video recording, live streaming, conferencing, centralized content management, and seamless interoperability with HIS, PACS, EMR, DICOM, and the Learning Management System (LMS).

Major operating rooms are equipped with 4K video routing, Picture-in-Picture (PIP)/Quad display, multi-channel recording, and robotic surgery integration, while minor operating rooms support Full HD streaming and recording through shared communication carts. A centralized AV control room enables real-time editing, tagging, content enrichment, DICOM export, and secure archival. A custom web application facilitates remote access, live surgical broadcasts, conference management, and role-based user access.

Key features include centralized dashboards, digital procedure documentation, patient safety traceability, secure media management, real-time collaboration, KPI reporting, and compliance with NABH Digital Health Standards across AAC, COP, DIS, DOM, and IMS.

Digital Implementation Highlight

The Digital Operating Room (OR) Integration project was implemented in a phased manner over approximately 12 months, covering planning, infrastructure readiness, installation, system integration, testing, user acceptance, and go-live across 21 operating rooms. The phased rollout ensured uninterrupted surgical services while enabling gradual adoption of the new digital workflows.

The implementation covered all major surgical specialties and involved the Departments of Surgery, Anaesthesia, Nursing, Operation Theatre Services, Information Technology, Biomedical Engineering, Medical Education, Hospital Administration, and Quality. Integration with HIS, PACS, EMR, DICOM, and the Learning Management System (LMS) ensured seamless clinical and educational workflows.

More than 250 stakeholders, including surgeons, anaesthetists, OT technicians, nurses, residents, biomedical engineers, and IT personnel, received structured training through classroom sessions, hands-on demonstrations, workflow simulations, and post-implementation support. Super users and department champions were identified to facilitate adoption and provide first-level support.

The initiative was led by a multidisciplinary Steering Committee comprising hospital leadership, clinical champions, the Information Technology team, Operation Theatre management, Nursing leadership, Biomedical Engineering, Quality Department, and the technology partner. Continuous stakeholder engagement, regular review meetings, and change management activities ensured smooth implementation, high user acceptance, and sustainable digital transformation.

Digital Impact

The Digital Operating Room (OR) Integration transformed surgical operations by standardizing workflows across 21 operating rooms and enabling seamless collaboration, recording, and information sharing. Automated video capture, centralized content management, and integration with HIS, PACS, EMR, and DICOM significantly reduced manual effort, improved documentation quality, and accelerated retrieval of surgical records for clinical review, teaching, and medicolegal requirements. Real-time live streaming and digital conferencing enhanced multidisciplinary discussions and medical education while reducing setup time and improving operating room utilization. From a quality and patient safety perspective, the solution established a complete digital trail of every procedure, improving traceability, accountability, and audit readiness. Reduced equipment clutter and fewer personnel inside the operating room helped maintain sterile environments and minimize infection risks. Standardized digital workflows strengthened compliance with surgical safety protocols and enhanced continuity of care. The initiative contributed significantly to PSG Hospitals achieving NABH Digital Health Standards (Gold) certification by strengthening compliance with Information

Management System (IMS), Access, Assessment and Continuity of Care (AAC/COP), Documentation (DIS), and DOM standards. The integrated digital platform has also positioned the hospital as a leading centre for digitally enabled surgery, clinical collaboration, and medical education, supporting continuous quality improvement and future-ready healthcare delivery

Key Enablers / Innovations

The successful implementation of the Digital Operating Room (OR) Integration project was enabled by strong leadership support, a multidisciplinary governance model, and active participation from surgeons, anaesthetists, nursing, Operation Theatre services, Information Technology, Biomedical Engineering, Quality, and the technology partner. Clinical champions played a pivotal role in defining workflows, validating system functionality, and driving user adoption. Comprehensive requirement analysis, process mapping, and phased implementation ensured minimal disruption to surgical services while aligning the solution with NABH Digital Health Standards. The project introduced several innovations, including centralized AV-over-IP architecture, 4K video routing, multi-channel recording, live surgical streaming, real-time conferencing, centralized media management, and seamless integration with HIS, PACS, EMR, DICOM, and the Learning Management System. These capabilities transformed operating rooms into connected environments supporting patient care, education, research, and quality improvement. Key challenges included integrating diverse clinical systems, maintaining uninterrupted surgical operations during deployment, ensuring reliable network performance for high-definition streaming, and training multidisciplinary users.

Key Learnings & Sustainability

The Digital Operating Room (OR) Integration project demonstrated that successful digital transformation depends on equal emphasis on technology, clinical workflows, and change management. Three key learnings emerged: first, early engagement of surgeons, nursing staff, OT technicians, IT, Biomedical Engineering, and Quality teams is essential for designing user-centric solutions; second, phased implementation with comprehensive training minimizes disruption and improves user adoption; and third, interoperability with HIS, PACS, EMR, and other clinical systems is critical for achieving sustainable digital workflows and regulatory compliance. To ensure long-term sustainability, PSG Hospitals established standardized operating procedures, preventive maintenance schedules, continuous user training, system performance monitoring, and periodic technology upgrades. The scalable AV-over-IP architecture allows future expansion, including AI-assisted surgical analytics and advanced tele-mentoring. Hospitals planning similar initiatives should conduct detailed workflow assessments, secure leadership commitment, identify clinical champions, invest in reliable network infrastructure, and adopt a phased implementation strategy with measurable quality indicators.

Reference Sources (If Applicable)

following standards, frameworks, and technical references were used in planning, implementation, and evaluation:

NABH Digital Health Standards, National Accreditation Board for Hospitals & Healthcare Providers (NABH), Quality Council of India (QCI) “ Reference framework for digital health compliance, including Information Management System (IMS), Access, Assessment and Continuity of Care (AAC/COP), Documentation (DIS), and Departmental Operations Management (DOM).

NABH Hospital Accreditation Standards, National Accreditation Board for Hospitals & Healthcare Providers (NABH), Quality Council of India.

DICOM (Digital Imaging and Communications in Medicine) Standard “ For interoperability and exchange of medical imaging and multimedia data.

HL7 Healthcare Interoperability Standards “ Reference framework for integration between Hospital Information System (HIS), Electronic Medical Records (EMR), Picture Archiving and Communication System (PACS), and other clinical applications.

Esbee Dynamed “ CREA Operating Room Integration Platform “ Technical documentation and implementation guidelines for the AV-over-IP, surgical video management, conferencing, and centralized media management solution.

Internal project documents of PSG Hospitals, including workflow analysis, implementation plans, user training records, standard operating procedures (SOPs), validation reports, and post-implementation quality review reports, were also used in preparing this case study.

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