

Healthcare Reimagined: How Smart Connected Hospitals Leverage Data to Transform Patient Care

Across the globe, hospitals are digitally transforming. Hospital systems are evolving their infrastructure to enable scalability, broad data access, streamlined workflows, and better patient care.

From AI and analytics to 5G networks, hospitals today are embracing new technologies for patient care by making investments in solutions such as high-resolution ultrasound machines, telehealth services, and virtual ICUs. However, transformative change is complex, and this piecemeal approach to infrastructure development has proven insufficient over time as hospitals struggle to support an influx of new patients and address shortfalls in clinical staffing.

Given these challenges, hospitals and other healthcare providers are rethinking how they operate. They are taking a more comprehensive approach to infrastructure upgrades to ensure they can meet the needs of clinical and business units dealing with ever-changing operational demands and financial requirements. Accordingly, they are deploying technologies that help connect people, processes, systems, applications, data, devices, and physical structures—enabling more-seamless workflows and broader data access.

Known as smart hospitals, these digital-first institutions are also deploying artificial intelligence (AI) and machine learning across the organization. These technologies are allowing them to distill clinical and business insights from the data generated

by their ever-growing networks of connected devices. To ensure that patient care is delivered in the right way, setting, and time frame, smart hospitals are also implementing technologies that enable secure data sharing between specialty clinics, primary care providers, and other external entities involved in the broader distribution of care.

Smart clinical journeys

Foundational to the smart hospital model is a unified technological framework that ties the institution's various clinical and business processes and devices together. This can align and coordinate the most complex operations in ways that accelerate and enhance patient care.

The breadth of data that smart hospitals generate is captured, analyzed, and available to inform decision-making, expedite clinical processes, and streamline patient journeys from edge to cloud. This sets the stage to enable personalized care and improve diagnosis and treatments while also helping to deliver operational efficiencies. The end result: better patient care, enhanced clinician productivity, and improved financial performance.

How smart hospitals can leverage their data:

Patient and clinical benefits	Operational benefits	Financial benefits
<p>Applying AI, analytics, and 5G networks to diagnoses, treatments, and monitoring</p> <ul style="list-style-type: none">Detecting sepsis and other issues earlierDelivering fast medical imaging analysis and decision supportAnalyzing all the patient data in near-real time for a more comprehensive view of patient data <p>Connecting systems, applications, and data to broader distribution of care</p> <ul style="list-style-type: none">Ensuring fast, seamless patient journeysDelivering care in the optimum venue <p>Sharing data expansively, securely</p> <p>Guiding industry advances to improving the health of individuals and populations</p> <ul style="list-style-type: none">Enabling genomics and precision medicine for personalized treatment plans	<p>Managing clinical throughput and streamlining patient journeys</p> <p>Maintaining devices with greater precision via predictive analytics</p> <p>Assessing patients autonomously using sensors and AI</p> <p>Improving efficiencies and freeing up resources by using telehealth platforms for routine care</p> <p>Breaking data silos from edge to cloud to integrate data and improve operational and clinical efficiencies</p> <p>Tracking and managing assets:</p> <ul style="list-style-type: none">Timely restockingIncreasing resource utilization ratesEfficient, effective staffing	<p>Accelerating claims processing</p> <p>Reducing the time patients stay in the hospital</p> <p>Redirecting patients to clinics, healthcare providers, and telehealth platforms when valuable hospital resources are not essential to their treatment</p>



Smart hospital at a glance: A guided tour

The connected care model delivered by smart hospitals employs high-performance edge computing, AI, data analytics, robotics, 5G, cloud computing, and other fast-advancing technologies to automate repetitive tasks and reduce inefficiencies so that the clinical team can focus their skills and efforts on the higher-value service needs of patients.

This paradigm allows care to be provided in ways that could not be performed by humans alone and enables patient journeys that are seamlessly coordinated from admission to discharge across all points of care delivery. Here's a snapshot of the intelligent healthcare tools and technologies early adopters are leveraging today:



Figure 1.
With data analytics deployed at the edge and high-speed connectivity, critical data flows through the smart hospital to where it's needed in near-real time. Combined with automated processes speeds service delivery and increasing efficiency.

1 Registration

Equipped with advanced robotics and sensors to process audio and visual input, AI-driven kiosks check patients in on-site and remotely, take patient temperatures and check vital signs, accept payments, and provide digital wayfinding to help patients navigate their way through the hospital campus. Smart hospital mobile apps connect patients to hospital systems, data, and staff as well as for registration and wayfinding—and for intelligent, automated support for many aspects of the patient journey. In enabling this type of digital front door model for patients, smart hospitals promote a smooth, frictionless patient experience overall.

2 Nurses' station

The nurses' station serves as the hub of patient care. In a smart hospital setting, patient data from all monitoring devices is consolidated and displayed in a single dashboard view for nurses. AI and predictive analytics are applied to the vast amounts of patient data generated, giving nurses the insights needed to remotely monitor multiple patients and effectively administer their care. AI-driven alerting systems reduce false alarms and prioritize alarm criticality, which can help cut down on alarm fatigue for nurses. Telemedicine solutions enable the delivery of remote care and communication between patients, nurses, and other clinical staff, both internally and across additional locations throughout the community's healthcare network.

3 Emergency department (ED)

Emergency department systems and applications are connected throughout the smart hospital's technological ecosystem and with outside healthcare entities as well. This model allows emergency vehicle systems, for example, to securely share near-real-time patient data with the emergency department while in transit to the hospital. This helps emergency departments prepare for the patient's arrival and provides the visibility required for them to prioritize patients with the most urgent needs. This data could also be used to provide information back to the emergency vehicle if the hospital is at capacity or the patient's needs would be best served by diverting them to another hospital. Connectivity and shared data across the hospital's infrastructure allow emergency departments to access critical data and coordinate with other departments so they are ready to provide follow-on care for the hospital's most critical patients.

4 Imaging room

High-performance edge computing combined with high-bandwidth private 5G connectivity enable near-real-time processing and distributed access to data-intensive medical imaging workloads. As a result, exceptionally high-resolution ultrasounds, MRIs, and other imaging files are quickly accessible to radiologists and other clinicians throughout the hospital. Data generated across all imaging devices is combined into a single master file for a highly granular, comprehensive view of patient conditions. Advanced AI and predictive analytics are applied to patient data to inform diagnoses and treatment decisions. AI-enabled analytics can help speed up the time to diagnosis and improve accuracy in diagnosing rare conditions.



5 Operating room (OR)

Advanced 5G wireless networks connect medical devices and give surgical teams full mobility around the patient—without the risks associated with wired equipment. Robotics aid surgeries and bring new levels of precision to minimally invasive procedures, and AI-enabled preemptive warnings promote patient safety. High performance computing platforms power AR, VR, and overlay technologies that educate patients on their surgeries in advance and help staff members prepare for, practice, and guide procedures. These solutions also allow broadcasting of live surgeries for training purposes and for enabling remote assistance and consultation. Cameras and other sensors around the operating room—and throughout the smart hospital—track the location of operating room assets, including equipment, tools, and personnel. These analytics can help ensure that the required tools are accessible when needed while also helping to support decision-making, enhance patient safety, and improve operational efficiency.

6 Intensive care unit

AI and multimodal sensor fusion are employed along with predictive analytics to aid in fall prevention and to detect and prevent the development of sepsis and other critical care issues. Near-real-time transfers of biological data and alerts to care teams improve their response times. Precise, continuous recording of data eliminates gaps in documentation that can compromise reporting and lead to reimbursement issues. Remote monitoring of patients protects staff from infections and allows clinicians the visibility they need to monitor high volumes of patients—up to 100 or more from a single device—from anywhere within or outside the hospital. Remote monitoring and telehealth systems can be leveraged throughout a broader healthcare network as well to enable hospitals that have extra internal capacity to assist other hospitals with patient monitoring when needed.

7 Patient room

Volumes of data are generated by monitors connected to patients. Smart hospitals capture patient data through sensors and the devices themselves and then apply advanced AI and analytics to uncover clinical insights. Telehealth systems enable real-time communication between nurses and patients, and observation solutions allow patient conditions to be monitored remotely by nurses. Dynamic alerting aids in patient safety, and digital dashboards at the nurses' station track the ongoing status of patients. Smart building systems can also transform the patient room into an exam room while also accommodating their comfort with custom environmental settings and expanded entertainment options.

8 Pharmacy

Automation and smart supply chain technology can improve the way pharmacies operate and the way medications are delivered. Robotic kiosks travel throughout the smart hospital, delivering patient medications in the exact dosages to nurses' stations. For greater efficiency and enhanced patient safety, these kiosks automatically track who has accessed and received medications. Automated checkout from the physician's office can immediately trigger fulfillment of prescriptions at the pharmacy. With edge intelligence, patients can leave the hospital with their medications, which can help them avoid delays in beginning their treatments.



9 Lab

A fast-emerging trend in smart hospitals is the use of genomics to inform test results. High-performance edge computing accelerates clinical workflows. Robotics are used in large lab systems to enable automation at scale, processing more samples faster with fewer employees. Beyond delivering operational efficiencies, automated robotics aid in cost containment, increasingly important given the impact of the Protecting Access to Medicare Act (PAMA) of 2014.

10 Outpatient care

Smart hospitals are leveraging 5G and other network technologies to manage remote patient monitoring systems (RPMs) that track health conditions once a patient returns home. Remote monitoring enhances patient journeys while reserving a hospital's beds and other on-site resources for those with more urgent medical needs. Integration of hospital systems with a broader community healthcare network enables comfortable, convenient hospital at home scenarios for patients. Ultimately, delivering timely patient care in the optimum venue benefits the entire hospital ecosystem by speeding patient treatments and recovery and maximizing valuable—and scarce—hospital assets.

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