



# Hitachi Digital Services

## Smart Health Hubs: The Role of IoMT and Gen AI in Virtual Health Systems

### Executive Summary

Healthcare is shifting from hospital-based models to more community-focused care, driven by technologies like AI and the Internet of Medical Things (IoMT). Generative and agentic AI are streamlining clinical workflows, improving diagnostics, personalizing treatment, and reducing administrative burdens, while enhancing the overall patient experience. IoMT enables real-time remote monitoring through connected devices, allowing earlier interventions and proactive chronic disease management. This supports virtual hospitals and home healthcare hubs by delivering hospital-grade care in home settings, improving outcomes and reducing hospital admissions. AI-powered analytics, combined with continuous data from IoMT devices, help identify at-risk patients, optimize triage, and support personalized care plans. Improved data sharing across systems further strengthens care coordination and continuity. As these technologies grow, robust oversight and regulatory alignment are essential to ensure privacy, safety, and equitable access. Together, AI and IoMT are building a preventive, connected, and patient-centered healthcare system.

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## Rise of Virtual Hospitals/Health Systems and Home Healthcare Hubs

Digital healthcare models are reshaping how care is delivered, using tools like telemedicine, remote monitoring, and digital health platforms to improve access and personalize treatment. Telemedicine and remote monitoring allow patients to consult with providers and manage their conditions from home, helping reduce hospital visits and improve outcomes, especially in underserved areas. These technologies also support the development of virtual wards, aligning with broader efforts in population health management (PHM) by enabling early interventions based on continuous risk assessment.

### Key Features of Digital Healthcare Models

| Feature                                         | Description                                                                                          |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------|
| <b>Telemedicine &amp; Remote Monitoring</b>     | Allow consultations and condition management from home; reduce hospital visits and improve outcomes. |
| <b>Virtual Wards</b>                            | Support population health management via early intervention and risk assessment.                     |
| <b>Mobile Apps &amp; Wearables</b>              | Enable real-time health monitoring, medication reminders, and data sharing.                          |
| <b>Segmented Engagement</b>                     | Uses data analytics for personalized outreach to at-risk groups.                                     |
| <b>SDOH Integration</b>                         | Address social determinants through community health strategies.                                     |
| <b>Centralized Digital Platforms</b>            | Provide access to health records, scheduling, and communication.                                     |
| <b>Clinical Decision Support Systems (CDSS)</b> | AI tools assist in diagnosis and treatment plans.                                                    |
| <b>Digital Twins</b>                            | Enable scenario modeling for personalized and system-level decisions.                                |

Digital platforms further enhance care coordination by providing centralized access to health records, appointment scheduling, and communication tools. They streamline workflows and reduce duplication, enabling a more integrated care experience. Intelligent clinical decision support systems (CDSS) use AI to assist providers with diagnoses and treatment plans, improving accuracy and efficiency. Clinical and operational digital twins allow for scenario modeling and planning, supporting precision medicine and system-level decision-making.

### Public health benefits

| Benefit                                        | How It's Achieved                                                            |
|------------------------------------------------|------------------------------------------------------------------------------|
| <b>Real-Time Health Monitoring</b>             | Use of epidemiological tools and data integration.                           |
| <b>Early Detection &amp; Interventions</b>     | Continuous engagement and risk analytics.                                    |
| <b>Collaboration for Health Management</b>     | Coordination between providers, governments, and third-sector organizations. |
| <b>Addressing Medical &amp; Social Factors</b> | Holistic care planning informed by integrated data.                          |



### Amino Health

#### Smart Choices Start Here!

Amino Health transforms how patients access care by turning complex healthcare data into actionable guidance. Through AI-powered navigation, it helps users find the right provider based on real-time insights into cost, quality, and insurance coverage. Whether managing a chronic condition or seeking preventive care, Amino personalizes the journey—making smarter, value-driven decisions easier than ever.



### Zocdoc

#### Your Doctor. Your Time.!

Zocdoc brings simplicity to scheduling healthcare. Its intuitive platform uses intelligent matching to connect users with in-network providers, often offering same-day appointments. By eliminating the hassle of phone calls and paperwork, Zocdoc empowers patients to take control of their care—anytime, anywhere—with just a few taps.



### AliveCor - KardiaMobile

#### Your Heart, In Your Hands

The **KardiaMobile** from AliveCor brings clinical-grade ECG monitoring to your smartphone. Designed for on-the-go use, it detects arrhythmias and other heart anomalies in seconds—empowering early intervention and peace of mind, right from home.

These digital models are laying the groundwork for the rise of virtual hospitals and home healthcare hubs. By combining remote monitoring, AI-based tools, digital platforms, and centralized care coordination, healthcare systems can now deliver high-quality care outside of traditional hospital settings. Virtual hospitals offer continuous, coordinated care through digital channels, while home healthcare hubs extend services directly to patients' homes. Together, they represent a shift from reactive, facility-based care to proactive, community-focused models aimed at improving long-term health outcomes.

## AI at the Core of Virtual Health Systems and Digital Hospitals

AI is playing a central role in advancing virtual health systems and digital hospitals by supporting proactive care, improving clinical decision-making, and streamlining operations. In digital settings, AI tools like risk analysis, patient segmentation, and deterioration monitoring help clinicians detect early warning signs and act quickly. At the same time, operational efficiency improves through AI-enabled automation of administrative tasks and real-time analysis of patient flow. These tools enhance care coordination and resource planning, allowing for more responsive, data-driven healthcare delivery.

Virtual consultations are becoming more effective with AI enhancements. Natural language processing (NLP) tools can summarize medical histories and translate clinical terms for patients, while AI video analytics help assess non-verbal cues like stress or pain. AI-driven triage systems prioritize patients based on urgency, ensuring timely specialist input. Combined with deterioration monitoring in virtual wards, these tools allow for continuous patient oversight and more accurate, remote decision-making.

**Role of Gen AI in patient interaction and clinical support**

| Category                          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Gen AI-Powered Virtual Assistants | Gen AI-powered virtual assistants are also reshaping patient interaction. These systems manage administrative tasks such as scheduling and reminders, provide personalized health information, and offer emotional support. Some assistants can even guide patients within health facilities when integrated with location-tracking systems. When paired with agentic AI models, virtual assistants help maintain two-way communication between patients and care teams, enhancing responsiveness and improving workflow efficiency. |



### Hinge Health

**"Your physical therapist, motion coach, and data scientist—all in one app."**

*Hinge Health revolutionizes MSK care with motion sensors, virtual physical therapy, and live health coaches. Patients receive tailored programs for back and joint pain, guided by real-time feedback and progress tracking. Trusted by Fortune 500 employers, it brings better outcomes and fewer surgeries—without leaving the house.*



### Kaia Health

**"AI that sees your posture—and helps fix it."**

*Kaia Health uses advanced AI and computer vision to guide users through physical therapy exercises using just a smartphone camera. No wearables, no appointments—just intelligent, adaptive training that adjusts to your body. It's like having a physiotherapist in your pocket, making therapy accessible anytime, anywhere.*



### SWORD Health

**"Where clinical care meets sensor precision."**

*SWORD pairs wearable motion sensors with licensed physical therapists to deliver expert-led MSK care remotely. Patients receive real-time form correction, personalized therapy plans, and continuous monitoring from certified clinicians. It's redefining recovery—clinically validated, globally scalable, and deeply human.*

| Category                          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>AI-Powered User Interfaces</b> | User interfaces powered by AI further enhance accessibility and personalization. Voice controls, adaptive layouts, and multilingual support ensure that platforms are usable across a wide range of patient needs. Gen AI adds another layer of personalization by integrating medical histories, lifestyle data, and genetic information to deliver tailored care plans. It also supports clinicians by offering real-time summaries of protocols, literature reviews, and diagnostic recommendations, helping maintain accuracy and consistency in clinical decisions. |

By enabling continuous monitoring, real-time decision support, and personalized care delivery, AI helps shift healthcare away from traditional inpatient settings toward more decentralized, home-based care. Virtual environments powered by AI not only expand access but also improve outcomes, reduce strain on healthcare systems, and support a more integrated and responsive model of care.

## Seamless Patient Oversight: The Role of IoMT and Remote Monitoring in Virtual Health Ecosystem

The integration of IoMT, RTLS, vision systems, and advanced medical devices is reshaping healthcare delivery by enabling continuous monitoring, improved diagnostics, and more efficient operations. IoMT devices, including wearables and connected sensors, track vital signs in real time, transmitting data directly into electronic health records. This real-time stream of health data supports early intervention, personalized care, and better chronic disease management, reducing the need for in-person visits.

RTLS enhances operational workflows in hospital settings by tracking the location of staff, patients, and medical equipment. This not only improves resource allocation and safety but also minimizes delays in care delivery. Vision systems, using high-precision imaging and computer vision tools, help improve diagnostic accuracy, particularly in areas such as radiology and wound care, by enabling detailed visual assessments without requiring physical appointments.

At-home diagnostics, powered by compact AI-enabled chips, allow patients to perform tests and collect health data from home. These self-collection tools improve accessibility, especially for individuals with mobility challenges or those in remote areas. Enhanced by new processing technologies, these tools are becoming more accurate and responsive, supporting faster results and real-time health insights.



### Lunit

#### **Precision Oncology Meets AI Insight!**

*Lunit's AI-powered diagnostic suite is revolutionizing how oncologists interpret imaging and clinical data. From detecting subtle patterns in X-rays to aligning treatment paths with the most current oncology research, Lunit helps clinicians make evidence-based decisions faster—reducing diagnostic delays and enhancing patient-specific cancer care. Already in use across major health systems globally, Lunit is becoming a vital digital ally in the fight against cancer.*



### Stanford Health Care

#### **AI That Frees Up the Doctor-Patient Connection!**

*At Stanford Health Care, AI is more than just a tool—it's a partner in the exam room. With intelligent transcription capturing every detail of doctor-patient conversations in real time, physicians can stay focused on listening instead of typing. These smart systems then auto-generate personalized care plans, schedule follow-ups, and reduce administrative overhead—helping care teams deliver seamless, thoughtful experiences without missing a beat.*



### Abbott - FreeStyle Libre

#### **Smarter Glucose Monitoring, Seamlessly Delivered!**

*Abbott's FreeStyle Libre transforms diabetes care through continuous glucose monitoring that is discreet, painless, and rich in insights.*

Gen AI further improves diagnostic precision by analyzing large datasets from EHRs, medical imaging, and wearable devices. These algorithms predict health risks, detect early signs of complications, and adjust care recommendations as new data emerges. Gen AI applications are especially impactful in post-operative monitoring and chronic condition management, providing timely alerts to clinicians and reducing the risk of preventable complications.

Shift from Hospital Beds to virtual hospitals/Home-healthcare hubs

| Traditional Hospital Model      | Tech-Enabled virtual hospital/Home-healthcare hub |
|---------------------------------|---------------------------------------------------|
| Physical hospital beds required | Hospital-level care delivered in home settings    |
| Periodic monitoring             | Round-the-clock supervision                       |
| Centralized care                | Decentralized and community-based care            |
| Manual diagnostics              | AI-enabled at-home diagnostics                    |
| Higher admission rates          | Fewer hospital admissions, scalable care          |

Navigating Data Security and Compliance in Virtual and AI-Enabled Healthcare

The expansion of IoMT and AI in healthcare brings critical data privacy and security challenges. These systems continuously collect, transmit, and process sensitive patient information, making them susceptible to cyber threats. To mitigate risks, encryption is essential for both data in transit and at rest. Lightweight cryptographic protocols and blockchain solutions improve data integrity and prevent tampering, especially in federated learning environments where raw data is not shared. AI-powered intrusion detection systems further enhance security by identifying unusual patterns or device spoofing attempts in real time.

Multi-Layered Security Mechanisms in Healthcare

| Mechanism                        | Function                                                                                                                       |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Multifactor Authentication (MFA) | Ensures access is limited to authorized users through biometrics and token-based systems.                                      |
| Role-Based Access Control (RBAC) | Restricts data visibility based on user roles.                                                                                 |
| Secure IoMT Onboarding           | Verifies device authenticity through cryptographic signatures.                                                                 |
| Threat Reduction                 | These approaches help reduce insider threats and protect against unauthorized access to patient records and hospital networks. |

To strengthen their cybersecurity posture, healthcare providers are focusing on routine audits, staff training, and well-defined incident response plans. Regular vulnerability scans and simulations help identify weaknesses early, while

🔒 AI-Driven Cryptography for IoMT

Securing Data Without Compromising Performance

Lightweight, AI-powered cryptographic protocols offer strong defense against data breaches while preserving efficiency in connected medical devices.

🔗 Blockchain for Trusted Health Data

Immutable Records, Instant Integrity

Blockchain frameworks ensure patient data remains untampered and traceable, enabling rapid breach detection and seamless regulatory compliance.

🔗 Blockchain-Backed IoMT Security

Glucose Monitoring That Guards Privacy

Hospitals integrating connected glucose monitors now use blockchain to encrypt and authenticate patient data—ensuring airtight compliance with GDPR and HIPAA’s toughest standards.

✅ OneTrust for IoMT Compliance

Your Audit Assistant in the Cloud

With OneTrust, healthcare systems can automate GDPR compliance audits for IoMT rollouts—minimizing risk, saving time, and staying ahead of regulatory demands.

🧠 AI-Driven Compliance in Imaging

Balancing Innovation with Regulation

As AI transforms medical imaging, protecting patient data is key. Compliance efforts focus on encryption, de-identification, and meeting HIPAA and GDPR standards to ensure secure, ethical AI use.

employee training addresses common risks like phishing. Coordinated efforts at the regional and national levels are also necessary to standardize security practices and prevent fragmented interpretations of regulatory standards, which can hinder effective implementation.

Regulatory Compliance and Data Protection

| Framework           | Requirements and Applications                                                                                                                                                               |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HIPAA               | Outlines strict safeguards for electronic protected health information (ePHI).                                                                                                              |
| GDPR                | Emphasizes data minimization and user rights over personal data.                                                                                                                            |
| Adaptation Measures | Adapting AI and IoMT systems to these regulations requires de-identification of datasets, secure device communication, and localized cloud storage that complies with data residency rules. |
| Compliance Tools    | Automated compliance tools and certified frameworks like ISO 27001 support these efforts.                                                                                                   |

For virtual hospitals and home healthcare hubs, consistent data protection and compliance are essential. These systems rely on remote access and continuous data exchange, making privacy and security foundational. Standardized protocols across platforms ensure secure, interoperable care, while clear regulatory adherence enables scalable and cost-effective solutions. In these decentralized environments, protecting patient data isn't just a legal requirement—it's central to sustaining reliable, connected care.

Conclusion

The future of healthcare is shifting toward a digital-first, patient-centric model driven by AI and advanced technologies such as the IoMT, RTLS, vision systems, and medical devices. These innovations enable virtual care models, remote patient monitoring, and AI-driven patient segmentation, improving population health management and early deterioration detection. By expanding care beyond traditional settings, healthcare providers can proactively address health inequalities and accessibility challenges, ensuring more personalized and timely interventions.

Patients are becoming active participants in managing their health through AI-powered personal devices and applications that offer self-care guidance, risk assessment, and crisis prediction. This shift fosters greater engagement and continuous clinical oversight, leading to better-coordinated care and improved outcomes. A single, integrated digital health record (DHR) can streamline healthcare delivery, reduce duplication, and standardize care across the system. By integrating data across hospitals, primary care, and community settings, healthcare providers

Case Study Spotlight

OSF HealthCare & Fabric's AI-Powered Patient Service Transformation

Challenge

OSF HealthCare aimed to improve patient accessibility and reduce operational costs, especially within its contact center. The challenge? Streamlining interactions and enhancing service delivery, all while maintaining high-quality patient care.

Thinkitive's Innovative Solution

OSF HealthCare partnered with Fabric to deploy Clare, an AI-powered virtual care navigation assistant. Integrated into the OSF website, Clare acted as a 24/7 digital front door, guiding patients through a seamless experience. Key features included:

- Symptom checking:** Personalized guidance based on patient inputs
- Appointment scheduling:** Easy booking for in-person, telehealth, and asynchronous visits
- Resource navigation:** Directs patients to relevant clinical and non-clinical information
- Call diversion:** Reduces contact center volume by addressing inquiries instantly

Patient-Centric Design

Clare's around-the-clock availability improved accessibility for patients—whether they needed support during business hours or after hours—empowering them with more autonomy over their healthcare experience.

Impact & Results

- \$1.2M Savings:** Clare cut contact center costs by \$1.2 million, optimizing resource allocation.
- \$1.2M Revenue Boost:** Self-service options increased net patient revenue by \$1.2 million annually.
- Enhanced Access:** Improved patient access to services and self-help tools, boosting satisfaction.

can create an insights-driven ecosystem that enhances coordination, performance monitoring, and system-wide improvements.

Emerging technologies such as ambient sensing, vision/LiDAR systems, and AI-driven analytics will further revolutionize care by detecting patient risks, such as falls or frailty, and enabling timely interventions. Home healthcare hubs and virtual health systems will extend monitoring, diagnosis, and treatment beyond hospitals, improving access for underserved populations and those preferring home-based care. These hubs will support chronic disease management, post-operative care, and remote consultations, empowering patients with personalized digital tools while reducing pressure on traditional healthcare facilities.

AI-driven clinical decision support tools and automation will enhance workforce productivity, reduce administrative burdens, and optimize integrated care. Virtualized wards will enable seamless coordination across care teams, providing a holistic view of patient progress and ensuring high-quality, continuous care. As healthcare systems evolve, organizations must adapt their strategies and operations to embrace these digital transformations. Despite the challenges, these advancements will create a more efficient, equitable, and resilient healthcare ecosystem, ultimately improving patient experiences and health outcomes on a global scale.

## Case Study Spotlight

### **Thinkitive: Powering Seamless Patient Data Integration**

#### Client Snapshot

A fast-growing U.S.-based digital health tech company offering telehealth, RPM, and practice management solutions needed to unify data from IoT devices and multiple EHR systems—securely and at scale.

#### Thinkitive's Smart Solution

Thinkitive engineered a future-ready integration framework, featuring:

- **Device Bridge:** Real-time vitals captured via Bluetooth/NFC from wearables like Apple Health, Fitbit, iHealth & CGMs, synced to the RPM platform.
- **EHR Bridge:** Instant, standards-compliant (FHIR/HL7) data flow into diverse EHR systems for clinician access.
- **Microservices Architecture:** Built with REST APIs—scalable, secure, and ready to grow.

#### Impact Delivered

-  **Streamlined Interoperability** across devices and systems
-  **Faster Workflows** with reduced manual input
-  **HIPAA-Ready Compliance**, built into every layer

 **Result:** A fully integrated digital health ecosystem, delivering smarter care and better patient outcomes.

## About the Authors



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Eratha brings more than 18 years of expertise in product development, strategy, business process consulting, and market research. He has a wealth of experience in digital transformation within the healthcare and life sciences sectors.



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Samkit is an industry analyst focusing on the healthcare and life sciences industries. He applies his passion for technology and research to provide insights and intelligence for various technology domains.



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Swapnil has over 20 years of industry analyst and corporate strategy experience. His areas of focus span technology prerequisites such as blockchain, intelligent automation, hybrid cloud, AI and advanced analytics, and IoT.

## About Avasant

Avasant is a leading management consulting firm focused on translating the power of technology into realizable business strategies. Specializing in digital and IT transformation, sourcing advisory, global strategy, and governance services, Avasant prides itself on delivering high-value engagements through industry focused innovation and flexible client-based solutions.

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## About Hitachi Digital Services

Hitachi Digital Services, a wholly owned subsidiary of Hitachi, Ltd., is a global systems integrator powering mission-critical platforms with people and technology. We help enterprises build, integrate, and run physical and digital systems with tailored solutions in cloud, data, IoT, and ERP modernization, underpinned by advanced AI.

Combining Information Technology and Operational Technology (ITxOT), we drive efficiency, innovation and growth across industries. With over 110 years of Hitachi Group's engineering and technology leadership, Hitachi Digital Services is powering smarter systems for a safer, more sustainable future for everyone.

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