The Connected Patient: Building Infrastructure for a New Era of Distributed Care Delivery

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Introduction

The healthcare landscape is undergoing a period of unprecedented transformation. Technological advancements are pushing the boundaries of what's possible, with a focus on improving patient outcomes, delivering cost-effective care, and enhancing the overall patient experience. At the heart of this transformation lies a critical component: healthcare infrastructure.

Robust, scalable infrastructure is the foundation for innovation, enabling healthcare organizations to deliver personalized care, improve clinical outcomes, and ultimately, reshape the future of patient care.

This anthology of articles, powered by CHIME's Digital Health Insights and sponsored by Spectrum Business®, explores three key pillars of a future-proof healthcare infrastructure:

- **Normalization and Swarm-ilization:** Optimizing data flow and preparing for the ever-increasing demands of the Internet of Medical Things (IoMT) and artificial intelligence (AI).
- **Healthcare-at-Home Infrastructure:** Supporting remote patient monitoring and delivering high-quality care beyond the traditional hospital setting.
- **Managing Scalable AI Utilization:** Ensuring responsible and effective implementation of AI, maximizing its potential while mitigating risks.

By examining these areas, we will equip healthcare leaders with the knowledge and strategies necessary to build a future-ready modern infrastructure that supports innovation and delivers optimal patient outcomes.

From normalization to "swarm-ilization": Preparing for the future of infrastructure demands in healthcare

Healthcare organizations are some of the most demanding data environments in the world, requiring 24/7 access to critical systems that support life-or-death decision making. But after a tumultuous decade of digital development, they're also some of the most chaotic. Right now, few organizations can boast truly seamless, interoperable data pipelines that encompass all their major infrastructure components, even as they race to add AI tools to fuel clinical and operational efficiencies.

Balancing the need for agility and growth with security, data governance and infrastructure standardization isn't easy, especially as the number of edge systems and disparate data feeds continue to increase exponentially. However, embracing the concept of normalization can help.

The “new normalization” of healthcare infrastructure

Normalization is a term often used in relation to data governance, which is a key part of the systems organization process. However, it is bigger than that. Normalizing infrastructure itself is about making intentional choices to match up the high-capacity data demands and methodology of each individual system so that data can flow quickly, reliably and securely from edge device to data center and back again with low latency that meets time-sensitive care and demanding application needs.

The idea of “standardization” may make IT leaders feel locked in and constricted by a set of inflexible rules. A normalization approach accounts for the most important parts of the standardization discussion while enabling adaptation of networks in support of modern, fast-paced requirements — multiple locations, internet traffic and cloud-based applications, as well as medical devices, AI algorithms and generally higher expectations from consumers and end-users.

It’s not about ripping and replacing everything so it’s all the same. It’s about investing in connectivity solutions that become the foundation for all these systems, in a cohesive manner, to pave the way for improved governance and enhanced reliability.

“Hospitals and health systems cannot afford to continue investing in ‘legacy’ networking technology in today’s digital-first environment,” said Andrew Craver, Vice President of Segment Marketing at Spectrum Business. “By simply maintaining the status quo with respect to IT infrastructure, organizations risk losing their competitive edge.”

In this “new normal,” clinicians will benefit from better access and flow of patient data, reduced administrative burden, improved user interfaces and real-time data insights, while patients will enjoy more personalized care, better communication and collaboration among their clinicians, and improved health outcomes.

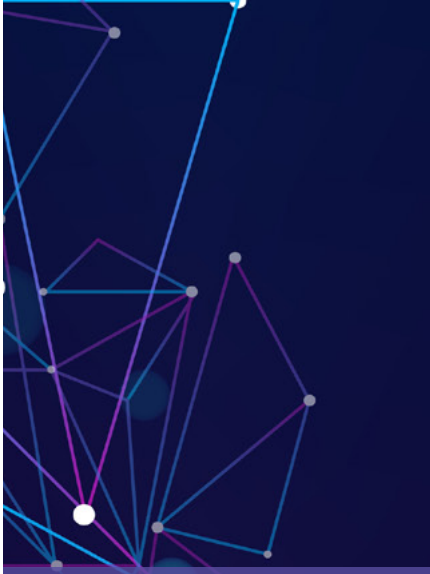
To get there, IT executives must evaluate existing network architecture; identify areas to improve digital experiences and secure data; and work across the entire organization to develop baseline standards that align with capabilities while preparing for future needs.

Overall, normalization will require investments in technology, training and other resources, but healthcare organizations can offset upfront costs with ROI realized via reduced redundancy, streamlined management, increased scalability and improved operational efficiency.

From norm to swarm: the future of data in healthcare

As the IoT and IoMT flourish, fueled by a surge of AI tools, healthcare organizations will be able to gather more diverse data from a wider range of sources. Moving from normalization to what CHIME and DHI refer to as “swarm-ilization” means developing the ability to accommodate high-speed feeds coming in from thousands of new and disparate sources. This will allow large organizations to cultivate richer, more profound data insights, akin to the “swarm intelligence” exhibited by bees, birds and other creatures. By democratizing access to patient behavior data, they can unlock a holistic understanding that fosters deeper insights and ultimately, better clinical outcomes.

“It is crucial to put modern infrastructure in place that scales efficiently as bandwidth needs increase,” Craver said. “To do so, healthcare organizations need a technology partner able to design, deploy and maintain modern networking solutions that prove resilient and reliable over time. By leaving the design, implementation and management tasks to network engineering experts, healthcare organizations free themselves up to focus their IT teams on delivering the best possible care.”



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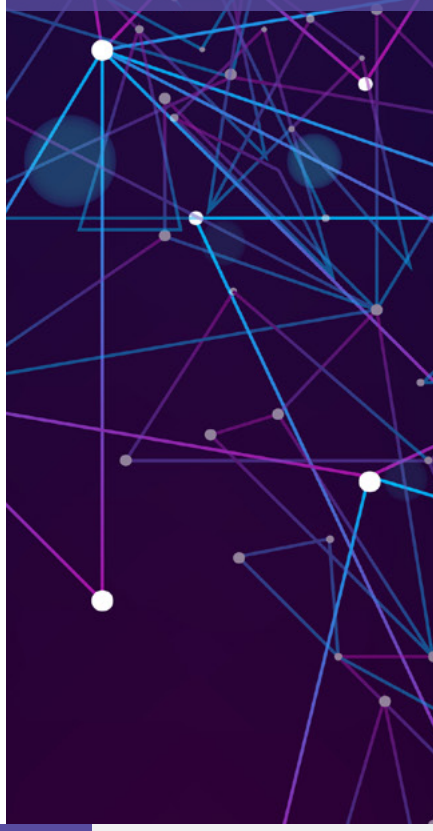


Infrastructure reimagined – connecting the patient bed to the data center

Patient care continues to move beyond the traditional healthcare facility, promising improved outcomes and other benefits, but placing increased demands on healthcare provider networks and digital transformation. For these expanded models of care to succeed, organizations need technology infrastructure that's robust enough to support secure information sharing and collaboration among disparate members of the clinical care team — this includes devices as well as internet and connectivity.

Homeward bound – improved outcomes

After decades of small-scale initiatives, in late 2020, the U.S. Centers for Medicare & Medicaid Services (CMS) issued Acute Hospital Care at Home flexibilities. Nearly 300 hospitals have participated to date. Though the program remains small in scale, McKinsey has estimated that up to 25% of all Medicare spending, some $265 billion per year, could be shifted to a care at home model.

The shift of the patient's bed outside the hospital presents significant opportunities. Patients are more comfortable in their own homes. Hospital-related complications are reduced. Advances in diagnostic and remote monitoring technologies, along with connected devices, are streamlining critical data delivery and connectivity, making it easier for care teams to coordinate care and keep close tabs on patients without being physically present.

Care at home offers potential advantages to the appropriate patients — namely, those with acute medical conditions who otherwise don't require 24/7 nursing supervision. They can recover in a familiar space, where the risk of hospital-acquired infection or a fall is significantly reduced. Additionally, care teams can more readily identify and address social determinants of health, such as limited access to food or poor ventilation.

On the operations side, overhead costs and readmissions are reduced. American Hospital Association data shows that providing care at home can cost approximately 40% less than an equivalent hospitalization and reduce 30-day hospital readmission rates. Looking specifically at the Acute Hospital Care at Home program, a *Journal of the American Medical Association* study found mortality rates "consistent with the hospital-at-home literature" along with "minimal complications" that required an emergency department visit or readmission. With this in mind, organizations cannot overlook the operational and technical infrastructure necessary to support care at home.

Meeting significant connectivity demands

The CMS has significant expectations for Acute Hospital Care at Home: Contracting with a range of third-party services (from lab and pharmacy to food services and durable medical equipment), supporting daily visits from practitioners, and establishing "immediate, on-demand remote audio connection" with the care team. That's a significant lift considering the average "length of stay" under the program is just five days, according to JAMA research.

The requirements for chronic condition management are less explicit but equally challenging. Patients need reliable technology to monitor vital signs and share patient-reported outcomes with their care teams; including devices as well as internet or cellular connectivity. Patients and caregivers often need assistance in obtaining, administering, and managing medications, especially those delivered by injection or infusion.

To support shared decision-making, care teams need access to patients' longitudinal records in applications familiar to them, along with the ability to collaborate virtually and make the right care decisions for the patients they serve. Given that care teams may include paramedics, social workers, and therapists in addition to employed nurses or physicians means supporting stakeholders with highly variable clinical workflows and work settings.

A one-size-fits-all approach to connectivity, data access, and collaboration is ill-suited to support a multidisciplinary care team. A solution that works for hospital-based staff may not meet the needs of traveling nurses, or vice versa. Poorly executed solutions are unlikely to be adopted, and outcomes are likely to suffer due to miscommunication, unidentified care gaps or non-clinical needs, limited insight into patient progress, and delays in providing necessary care. Instead, a multifaceted approach featuring a customized, scalable healthcare technology infrastructure results in better coordination, security and connectivity. This leads to fewer interruptions to care and, ultimately, better insights and outcomes.

Infrastructure that supports access

A 2022 study in BMC Health Services Research described success in continuity of care as providing "predictable and accessible care with continuous follow-ups" while establishing "cooperation based on knowledge, trust, and respect."

Patient experience significantly improves when organizations achieve these outcomes in their care-at-home models. Data from Press Ganey reveals a 12% improvement in patient experience for those receiving hospital care at home compared with those receiving in-hospital care.

Providers supporting care at home need technology infrastructure that delivers access to data, decision support, and collaboration without taking them out of the applications they already use. This helps ensure care teams meet patients' needs and demonstrate the value of care at home to their patients and their organizations.

A trusted technology partner can implement a digital infrastructure that secures important health data and ensures information is accessible among clinicians, departments and locations. By simplifying IT infrastructure with managed services and a scalable network, organizations can free up staff to focus on the mission of transforming lives through patient programs and care.

Managing AI Utilization to Ensure Optimal Business Results

Any enterprise that sees a pilot program improve efficiency or cut costs will seek to scale the initiative to any business unit that may benefit. This is especially true in the tough financial times that health systems now face, with rising expenses and reduced revenues putting pressure on margins, according to a recent McKinsey report.

Healthcare executives must be careful about scaling effectively, though. If an initiative fails to increase efficiency, reduce costs, improve care quality, or boost patient and employee satisfaction as anticipated, it will only be harder to get buy-in for the next innovation.

For many organizations, AI is the latest technology to pose scalability questions – not just about where and when to deploy AI, but also about how to govern its use. AI relies heavily on real-time data access and processing, making robust network infrastructure and consistent connectivity critical factors in generating accurate insights. As leaders address these questions and challenges, they should consider whether their technology provider's service-level agreements (SLAs) explicitly reflect these factors by ensuring uptime, bandwidth, and latency meet the specific needs of AI applications. Without a robust foundation, even the most sophisticated AI can be challenged by inconsistent data flow and processing delays.

AI comes with potential as well as cautions

There's no question AI has transformative potential in healthcare. Robotic Process Automation (RPA) takes tedious tasks out of workers' hands, from coding and processing medical claims to reminding patients about preventive screenings. Ambient assistants document clinical notes so physicians have more face time with patients. Generative AI has augmented everything from marketing communication to search queries to decision support.

However, this potential comes with cautions. There are many reasons why organizations fail to scale AI implementation and AI-driven insights. Here are several top considerations:

- **It seems so easy.** Needs, use cases, computing resources, and capabilities vary significantly among business units. The "lift and shift" approach rarely succeeds.
- **It's not driven from the top.** Business unit leaders may champion the use of process automation, decision support, or generative AI. Today, few non-IT senior executives do.
- **Data complexity is vastly underestimated.** Data from disparate sources, much of it unstructured, must be harmonized before it can be analyzed. That's a serious undertaking.
- **There aren't enough resources.** Small teams can handle a pilot, but few health systems have the IT professionals they need to manage enterprise-wide deployment.
- **Governance is often lacking.** Many organizations have not fully thought through how AI should be applied.
- **Insufficient infrastructure and bandwidth.** Data bottlenecks, processing delays, security risks, integration challenges and limited scalability can stifle AI projects and insights.

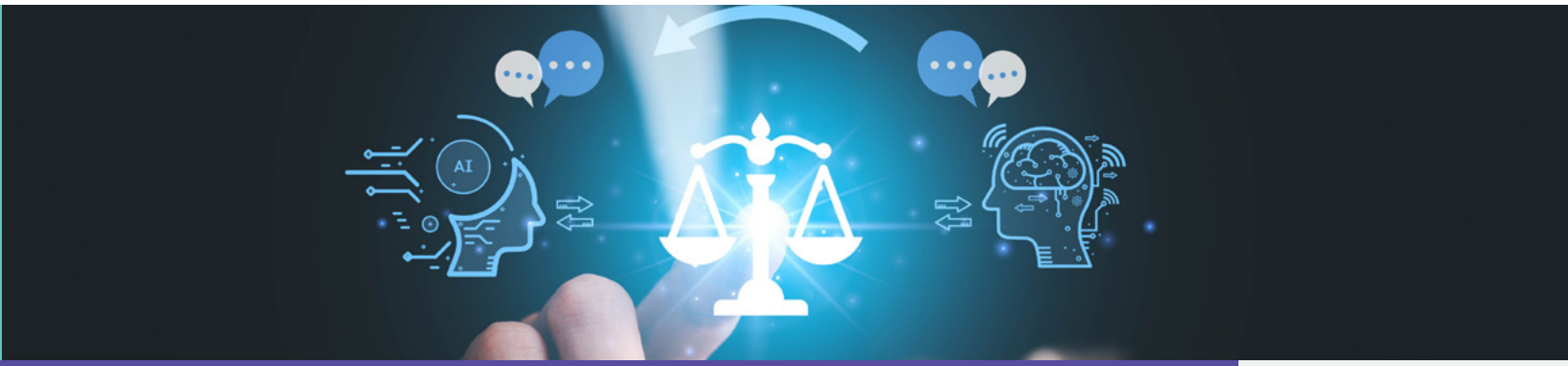
The role of AI governance

The first four problems, though not necessarily easy to solve, can be addressed with prudent planning, strategic resource allocation, and well-considered foresight. However, governance is a more challenging area. The Digital Health Most Wired (DHMW) 2023 survey found only 40% of respondents (representing a cross-section of U.S. health care providers) had AI-specific governance in place.

Governance isn't new to healthcare — after all, dictating who has the authority to perform tasks or access resources is fundamental to maintaining care quality and patient safety — but AI governance will take some work.

Organizations should start with who governs the deployment of AI for tasks such as billing, scheduling, and supply chain management. This ensures employees understand the role AI should play and where the "human in the loop" interaction should take place. In some specialties like radiology, AI is not new at all, so the familiarity with the technology across the enterprise is uneven.

The next and most challenging step is governance of AI that fully defines the relationship between the patient and the clinician. This is critical as staff need to know which data is available for decision support and when. They also need to be aware of complicated privacy and ethical issues regarding AI insights. Without this guidance, clinical staff are unlikely to consistently understand the insights that are actionable and those that are not — severely undermining AI's utility to them.



Scalable infrastructure and connectivity

As bandwidth intensive technologies such as AI emerge across the healthcare market, bandwidth and compute capacity upgrades across underlying networks often ensure consistent performance and scalable headroom for future growth.

Reliable, high-capacity network infrastructure ensures consistent data flow, which is critical for tasks like feeding "training data" into AI models or facilitating quick communication between associated applications, devices, and software. Healthcare organizations that leverage AI need consistent, high-performance throughput to enable data delivery, content connections, and application performance nationwide — across any fiber internet or Ethernet connection — on a network that consistently delivers on capacity demands.

Ultra-High Speed Data connectivity enables differentiated performance across bandwidth-intensive and cloud-based applications by accelerating data flow, reducing latency, and powering data transfer with speeds that scale up to 100 Gbps nationwide.

Infrastructure diversity is vital to the resilience, security, uptime, and flexibility of healthcare networks and operations. Organizations need to ensure resiliency and disaster recovery between major sites and the cloud with up to seven levels of diversity — DHMW data showed 40% to 50% of organizations cannot restore critical operations (e.g. network, communications, administrative, and clinical information systems) in under four hours, needing upwards of 24 hours to bring these systems back online.

Improving infrastructure diversity requires a multi-layered approach, including:

- **Multi-site architecture:** Geographically dispersed data centers across different regions provide redundancy in case of localized outages like natural disasters or power failures.
- **Multi-cloud adoption:** Leveraging multiple cloud providers or different regions within a single cloud provider (multi-region) creates geographically separate instances of critical applications and data.
- **Data backups:** Regular backups of data across various locations — including on-premises storage, secondary data centers, and the cloud — provide data diversity.
- **Monitoring:** Continuous monitoring performance of infrastructure, applications, and network connectivity helps proactively identify and address any potential issues.

Taking SLAs to the next level

Fortunately, CIOs don't have to go it alone. AI systems are designed to guide decision making that's tied to operational and clinical goals, from better efficiency through billing automation to increased patient engagement through personalized outreach. The SLA should clearly define infrastructure performance metrics such as network uptime, and latency. This ensures the infrastructure meets performance thresholds that AI applications require to avoid disruption.

CIOs can gain both the context necessary to flesh out governance policies for individual AI systems and a framework for an enterprise-wide AI governance strategy. This also will help ensure a resilient, scalable foundation for network performance and data flow for today and the future. When leaders understand AI's applications, how it is enabled and delivered, they improve the likelihood that AI will scale effectively and appropriately throughout their enterprise — and live up to its potential.

Conclusion

Building a robust healthcare infrastructure is not an option; it's a necessity. By embracing the concepts explored within this anthology — normalization, swarm-ilization, healthcare-at-home infrastructure considerations, and responsible AI governance — healthcare organizations can position themselves for a future of innovation and patient-centered care. A well-planned infrastructure becomes the bedrock for emerging technologies, empowering healthcare professionals to deliver the highest quality care possible. By strategically navigating the intricacies of infrastructure and AI, healthcare organizations can unlock a new era of healthcare delivery, driven by data, innovation, and a commitment to patient well-being.

Key Takeaways for Healthcare Providers

- Data-driven transformation starts here: A fragmented infrastructure stifles progress. Normalizing infrastructure ensures smooth data flow, paving the way for advanced analytics, AI initiatives, and improved decision making at all levels of your organization.
- Think beyond today: The future of healthcare is data intensive. As IoMT devices and AI adoption grow, infrastructure must be prepared to accommodate "swarm-ilization." Proactively scaling up networks and ensuring robust connectivity prepares you for this data surge.
- Home is the new healthcare hub: Infrastructure is a crucial component of the care-at-home revolution. Ensure seamless remote monitoring, robust data security, and network reliability to provide high-quality care outside hospital walls and optimize costs.
- AI isn't a magic bullet: To realize the full value of AI, careful planning is essential. Invest in a strong infrastructure foundation, focus on AI governance that prioritizes ethics and patient safety, and be clear on desired outcomes.
- Seek trusted partnerships: Infrastructure modernization cannot be done alone. Seek out technology partners who understand the unique challenges of healthcare, offer scalable solutions, and prioritize security and reliability to bolster your transformation efforts.

Remember, building a future-ready modern healthcare infrastructure is an ongoing journey. By embracing the strategic takeaways from this anthology, healthcare providers can navigate the evolving landscape, harness the power of emerging technologies, and ultimately improve the lives of their patients.

About Spectrum Business

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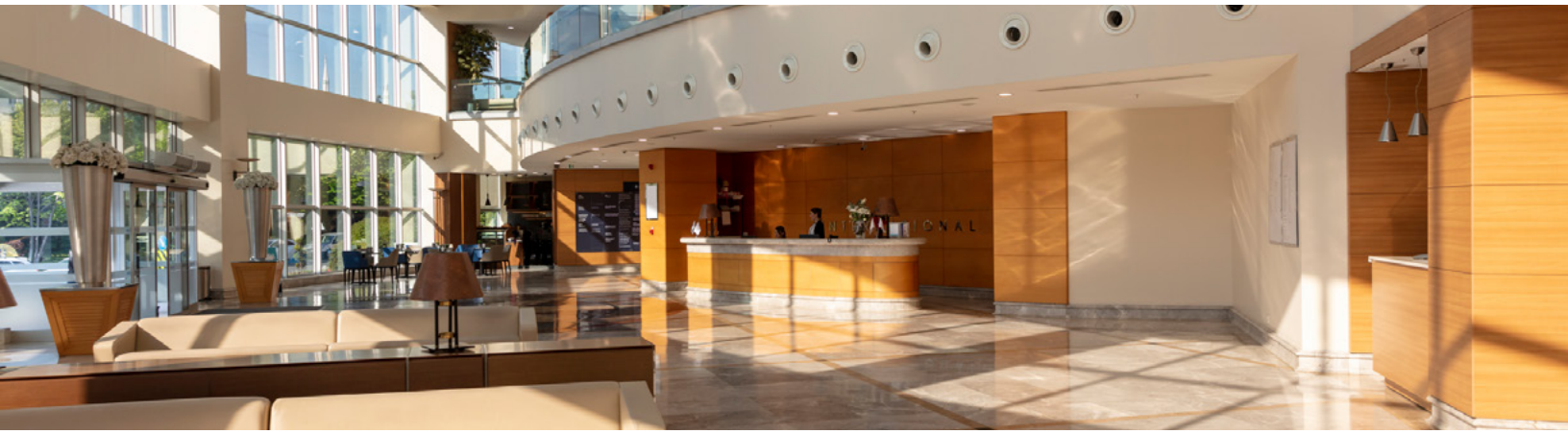

About DHI

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