



Smart, connected hospital framework

Strategies to optimize the value of digital technologies and improve organizational resiliency



Benjamin Kanter, MD, FCCP
Chief Medical Information Officer

What makes a hospital smart

Over the past two decades, hospital IT leaders have massively invested in digital technologies. For instance, they've built an electronic health record (EHR) infrastructure. They've implemented clinical systems like digital pathology, digital radiology, wireless nurse call, and smart beds. And they've deployed communications products such as secure messaging apps, smartphones, and other digital communication devices.

The longstanding focus of IT has been on EHR implementation and attempting to optimize the EHR user's experience. This has allowed little bandwidth for optimizing the value of investments in digital technologies, or for a strategic focus on effective cross-team communication that is so essential to the delivery of excellent clinical care.

Indeed, too many hospitals have invested too much money and effort installing digital systems and received too little value in return. Why? Because to derive optimal value from these data sources, a hospital needs to be "smart." And digital technology alone isn't what makes a hospital smart.

What makes a hospital smart is the ability to rapidly derive insight and value from data sources which, in turn, enables nurses and physicians to respond quickly and appropriately. The ROI is this ability to shorten the time to recognize and react to issues. Smart hospitals leverage data in near-real time, and to do it, they need digital technologies to be connected – that is, integrated within the clinical ecosystem through an intelligent clinical communication and collaboration platform.

The agility with which hospitals derive insight and value from data sources contributes to organizational resiliency.



Staffing shortages make complexity untenable

“Disconnected.” “Disjointed.” “Fragmented.” These are refrains we hear from clinical users describing their work environment and experience in delivering care with unintegrated technology. When technologies are siloed, the result is increased complexity for frontline care teams who must focus more on dealing with the tools than on the work of patient care.

Siloed IT systems generate immense numbers of alarms. The resulting chaos, noise, and distraction degrade a nurse’s ability to care for patients and contribute to cognitive burden that can exacerbate burnout. Siloed systems also generate massive volumes of data and information. When nurses and physicians are unaware of the information or unable to make sense of it, their response to incidents is likely to be delayed or ineffective.

Rounding out this perfect storm are the unprecedented staffing shortages hospitals are facing. The healthcare sector lost nearly half a million workers between February 2020 and November 2021,¹ and one study anticipates a global shortage of 13 million nurses by 2030.² Needing to take care of more people with fewer people makes the problem of fragmented communication and workflows untenable. If the problem remains unchecked, complications will negatively affect patient safety and outcomes.

A smart, connected hospital is a resilient hospital

To meet their goals of enabling positive outcomes, hospital IT leaders need to integrate communication with clinical and operational systems to fill in the gaps left by staff attrition. They need to create a more connected, coordinated, and integrated working environment and experience to help retain and attract workers.

In the CNO Perspective report, *Reimagining Nursing for the Future*, Rhonda Collins, DNP, RN, FAAN describes the concept of nurse extenders. A nurse extender is a technology, tool, process, or protocol that extends a nurse’s reach and influence. Dr. Collins advises that to think of how to transform the hospital’s systems into nurse extenders, start with the patient in the bed. A smart bed can, in near-real time, notify the correct caretaker when a patient is in a compromised state and at risk for injury, specifically helping to reduce falls and decubitus ulcers. For example, a nurse can be remotely alerted if a high-risk patient is attempting to exit the bed, if a bed configuration is not in compliance with hospital protocols, or if a patient hasn’t been turned in a set timeframe. A smart bed becomes the epicenter of patient care when it is linked with the systems surrounding it.

Integrated systems for communication and collaboration form the bedrock of the smart, connected hospital. They break down data silos, accelerate the conversion of data into information, and rapidly communicate new events to the most appropriate and available team members.

The agility with which hospitals derive insight and value from data sources contributes to organizational resiliency. A resilient organization rapidly adapts in response to challenges, be they pandemics, staffing shortages, or other internal or external stressors. The result is diminished impact from challenges and a more rapid recovery.³

Smart, connected hospital framework

We devised a smart, connected hospital framework to help IT leaders visualize how to make the most of investments in an EHR infrastructure and clinical and operational systems while improving the care team experience, patient safety, and other outcomes. The framework (Figure 1) illustrates how different types of interoperability work together in the clinical ecosystem starting with interconnected data sources and feeding upward into the end-user experience.

The smart, connected hospital framework consists of four layers:

- Input layer (the foundation)
- Aggregation and intelligent processing layer
- Experience layer
- Analytics layer

Integrated systems for communication and collaboration form the bedrock of the smart, connected hospital.

Smart, connected hospital framework

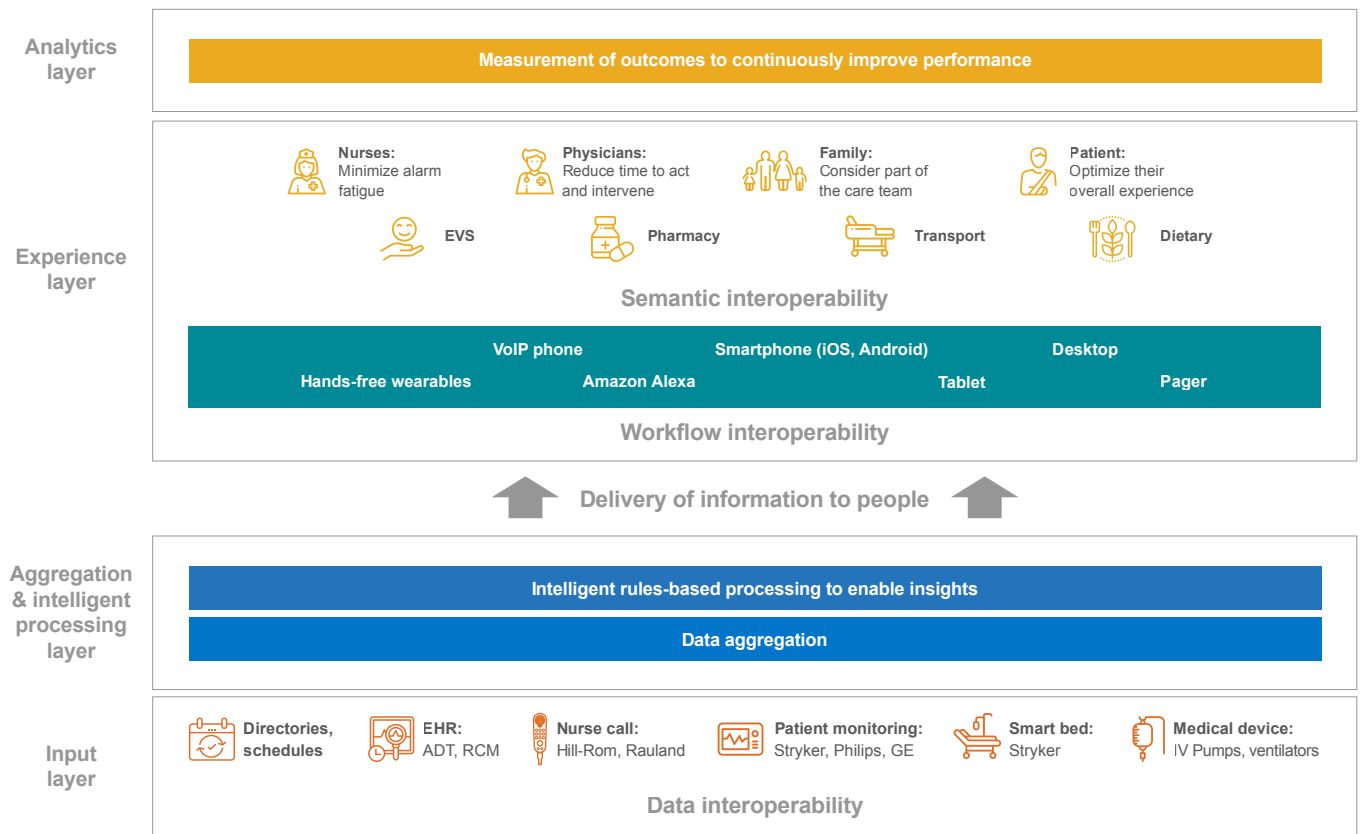


Figure 1: Smart, connected hospital framework

Different types of interoperability work together in the clinical ecosystem.



Smart, connected hospital framework (cont.)

Input layer (the foundation)

The input layer features **data interoperability** between healthcare IT systems such as the EHR, patient monitoring equipment, smart beds, and medical devices. Data interoperability creates the foundation for connectedness. It significantly reduces the human workload required to interpret output from disparate, siloed systems and enables a clinician to execute a care plan along a continuous care pathway. For example, when results from a hospital's lab information system are integrated with cardiac monitoring, a physician can more easily understand that a patient's new onset atrial fibrillation is due to an abnormally low potassium level.

Aggregation and intelligent processing layer

A broad need exists for clinicians to receive accurate, relevant information on which they can act, helping to reduce alarm fatigue and cognitive burden and strengthen patient safety. **Intelligent middleware** enables routing, escalation, and prioritization of communications and alarm notifications at scale, and delivers it with associated context about the patient, event, and care team. This layer builds upon the data interoperability of the input layer. As an example, the Vocera® Engage intelligent workflow engine uses standards such as Health Level 7 (HL7) to break down data siloes and prepare data for analysis.

Experience layer

In the experience layer, people receive information from multiple systems that has been aggregated and intelligently processed. A goal of **workflow interoperability** is to avoid creating siloed context and disconnected repositories of information. To achieve it, IT and clinical leaders need a deep understanding of the connection points among physician, nursing, and cross-team workflows – especially during transitions of care. As one example, most hospitals require a physician to directly communicate to a nurse when a new stat medication order has been placed. This is an intersection of a physician medication ordering workflow with a nurse's medication administration workflow. An intelligent clinical communication and collaboration platform automatically notifies the nurse when the stat order has been placed, reducing the communication burden for both parties.

Semantic interoperability deals with the intent and content of the messages exchanged among healthcare IT systems, not just the messaging format. The intent is what the person initiating communication is trying to accomplish. Are they calling one person or a group? Are they making a broadcast call? Are they sending a message? The intent can be thought of as the verb and the content as the subject. "Call Dr. Kanter" or "Connect me to Ben Kanter," or "I want to talk to Dr. Ben" each have identical intent and content, but they are expressed differently.

In healthcare, voice-user interfaces must be able to manage some degree of semantic interoperability to support different ways of expressing intent, and also to understand something as simple as a blood test result. For instance, nurses managing a patient's transfusion might express "hemoglobin and hematocrit" in various ways. They might say H/H, or H-and-H, or CBC, or complete blood count. Semantic interoperability enables each caregiver to communicate naturally and not have to remember to use one specific term. In this way, technology adapts to the users, not the other way around. Semantic interoperability should closely follow clinicians' natural language and interpret key words consistently across disparate systems to enable collaboration across teams and systems.

Smart, connected hospital framework (cont.)

End user communication devices reside between workflow interoperability and semantic interoperability. Each role within a hospital has unique workflows and communication needs. For each role there is an optimal communication device to enable a worker to perform their job with ease and efficiency (Figure 2). Healthcare leaders, with input from end users, should determine which devices to make available for use by which users, weighing support costs, security, and other administrative factors.

Do not let a communication platform dictate which end-user communication devices should be used. The best clinical communication and collaboration platforms are device agnostic. When you limit device choices, you limit how smart your hospital can be.

Analytics layer

Analytics help IT leaders measure clinical and economic outcomes and gauge the value they're receiving from digital technology investments. Continuous process improvement is a cornerstone in the development of a smart institution.

When you limit device choices, you limit how smart your hospital can be.

Role/Department	Recommended Solution			Device Assignment
	Vocera App on Smartphone	Smartbadge	Minibadge with Smartphone	
Leaders	X			Individual
Providers (MD, DO, NP, PA)	X			Individual
Care Management	X			Individual
Pharmacy	X			Shared
Lab/Phlebotomy	If using specimen collection on Vocera Edge	X		Shared
Nurses		X	X	Shared
UAPs (nurse aid PCNA)		X	X	Shared
HUCs		X	X	Shared
CRNAs/Anesthesiologists		X	X	Shared
EVS		X	X	Shared
Nutrition		X	X	Shared
Respiratory		X	X	Shared
Transport		X	X	Shared

Figure 2: General view of mobile communication devices by role in a healthcare setting

Let's have a conversation

Wherever you are on your journey from digital to smart, I invite you to connect with me to have a conversation about ideas, solutions, and possibilities. You can contact me at: bkanter@vocera.com

In summary: A digital hospital can become a smart hospital

It's not *digital* that makes a hospital smart; it's what you do with digital.

The ability for care team members to rapidly derive insight and value from data sources and, in turn, be able to respond quickly and appropriately is what makes a hospital smart. By connecting digital technologies within the clinical ecosystem and enabling deep interoperability, hospital leaders can transform a digital hospital into a smart hospital.

Implementing a modern communication and collaboration system is a strategy for unifying not only healthcare teams, but also the entire enterprise, tying together the clinical and administrative IT systems that are sources of data, information, and knowledge.

Using a smart, connected hospital framework, IT leaders can align their efforts with a predetermined, well-constructed plan rather than managing communication systems that grow organically without strategic governance or direction. They can better measure the value returned on digital assets and improve organizational resiliency. Better still, by simplifying communication and workflows, they can create a better work environment and experience for nurses, physicians, and the extended care team – enabling a better experience for patients and families.

Benjamin Kanter, MD, FCCP, is the Chief Medical Information Officer (CMIO) for Vocera, where he works closely with clinicians and engineers to co-design the next generation of real-time communication and collaboration solutions for hospitals and health systems. Prior to this role, Dr. Kanter worked as an industry consultant and thought leader with several innovative healthcare IT companies.

He also served as the CMIO at Palomar Health, where he spent seven years on the executive management team. As a medical staff leader, he chaired the departments of medicine at both Palomar Medical Center and Pomerado Hospital, where he was Chief of Staff. Under Dr. Kanter's leadership, Palomar Health achieved EMRAM level-6 at both hospitals.

About Vocera

Vocera, now part of Stryker, provides clinical communication and workflow solutions that help protect and connect team members, increase operational efficiency, enhance quality of care and safety, and humanize

the healthcare experience. Nearly 2,800 facilities worldwide, including more than 2,300 hospitals and healthcare facilities, have selected Vocera solutions to enable their workforce to communicate and collaborate, and engage with patients and families. Our platform can integrate with most clinical and operational systems used in hospitals. Mobile workers can choose the right device for their role and workflow, including smartphones or our wearable, hands-free communication devices, and use voice commands to easily reach people by name, role, or group. For more information, visit Vocera.com.

Stryker is one of the world's leading medical technology companies and, together with our customers, we are driven to make healthcare better. We offer innovative products and services in Medical and Surgical, Neurotechnology, Orthopaedics, and Spine that help improve patient and hospital outcomes. For more information, visit Stryker.com.

Learn more at www.vocera.com/smart-connected-hospital.

Contact us:

US/Canada: 1-(888)-986-2372

UK: 0 (800) 652-8773

UAE: 800-0182438

Australia: 1 300 862-372

New Zealand: 0800 446 149

Citations

1. The Employment Situation – December 2021. Bureau of Labor Statistics News Release, 7 Jan. 2022. <https://www.bls.gov/news.release/pdf/empisit.pdf>.
2. Gooch, Kelly. "World could be short 13 million nurses by 2030, report finds." Becker's Hospital Review. 25 Jan 2022. <https://www.beckershospitalreview.com/nursing/world-could-be-short-13-million-nurses-by-2030-report-finds.html>.
3. Barbash, Ian J. and Kahn, Jeremy. "Fostering Hospital Resilience—Lessons From COVID-19." JAMA Network. 29 July 2021. <https://jamanetwork.com/journals/jama/fullarticle/2782738>.

Stryker Corporation or its divisions or other corporate affiliated entities own, use, or have applied for the following trademarks or service marks: Stryker, Vocera. All other trademarks are trademarks of their respective owners or holders. Copyright © 2022 Stryker.

