Are We There Yet?

Inching Toward Interoperability

Chris Hayhurst

Almost four years ago, BI&T profiled several healthcare facilities that were tackling the issue of interoperability as it relates to the integration of device data into the electronic medical record. Here, we check in with two of those facilities again, and also take a look at one more.

A lot can happen over three and a half years, and a lot can remain the same. That, in a nutshell, is the story of interoperability—a topic AAMI covered in the January/February 2012 issue of BI&T and then, that October, dug into again with the AAMI/FDA Interoperability Summit. The 2012 article noted that “the path to full interoperability,” where accurate data flows quickly and seamlessly between medical devices and the electronic medical record (EMR), “is not smooth.”

Rather, it continued, those on the front-lines of medical-device integration often wind up “stuck in a quagmire of poorly defined standards, incompatible systems, infrastructure problems,” and unhelpful vendors. There were facilities, the piece showed, that had stepped up to address these many challenges, but each was still faced with significant work ahead, and none could be said to have reached full interoperability.

The fall 2012 summit, a two-day gathering of healthcare professionals and industry representatives (and convened with the U.S. Food and Drug Administration), honed in on this fact from the perspective of patient safety.

The report was clear in its ultimate conclusion—summarized best, perhaps, by Anura Fernando, a principal engineer with UL. When asked for his opinion on when we might know that interoperability had finally
become a reality, Fernando, an expert on standards for interoperable medical device interface safety, said this: “We will have achieved interoperability when we stop talking about it.”

Well, we’re still talking about it. Today, more than three years later, “interoperability” (see sidebar for a definition) has become one of healthcare’s biggest buzzwords, and as Fernando suggested, that’s not because it has actually been attained. Instead, true interoperability on a national scale continues to elude us—so much so, in fact, that in late January, when the U.S. Department of Health & Human Services (HHS) Office of the National Coordinator for Health Information Technology (ONC) published its “roadmap to interoperability” (see sidebar), it made it clear that the document was merely a draft, and that a new version would eventually be released that took into account all useful public feedback. (Also notably, the draft roadmap itself was a bulked-up revision of an ONC publication from 2014, Health and Care for the Nation: A 10-Year Vision to Achieve an Interoperable Health IT Infrastructure.) This roadmap, in other words, was meant to be seen as a “living document”—and not, as some hoped, as a step-by-step manual that anyone could follow to reach the hidden holy grail of interoperability.

Still, ONC notes on its website, the roadmap does offer significant guidance while proposing “critical actions” that stakeholders should take to create “a more connected, interoperable health IT infrastructure.” HHS Secretary Sylvia M. Burwell stressed the importance of such actions in a statement she made on the day of the roadmap’s release: “Great progress has been made to digitize the care experience,” she said. “It’s time to free up this data so patients and providers can securely access their health information when and where they need it.”

Among those providers who agree with Burwell are nurses. A report released this Spring by the he West Health Institute, an independent, nonprofit medical research organization, found that 50% of nurses “said they had witnessed a medical error because of lack of device coordination.” In addition, three of four nurses surveyed "strongly agreed that it is burdensome to coordinate the data collected by medical devices," and most suggested that “dealing with devices” significantly reduced the time they spent caring for their patients. The report, called Missed Connections: A Nurses Survey on Interoperability and Improved Patient Care, also cites earlier research by HIMSS Analytics indicating that while more than 90% of hospitals “use six or more types of devices that could be integrated with EHRs (i.e., defibrillators, electrocardiographs, vital signs monitors, ventilators and infusion pumps),” only one-third of those hospitals have actually integrated their devices. And those hospitals that do invest in interoperability? They “integrate fewer than three types of devices on average, a far cry from the six to 10 devices that may be present around an intensive care unit bed.” True medical-device interoperability, the report concludes, would “sharply reduce” medical errors (and patient deaths) by making device use simple while giving nurses and other clinicians easy access to the information they need to do the jobs they are trained to do. As one nurse who was not a part of that survey puts it, “Giving the medication is no big deal. Recording what you did in the computer—that’s a big deal.”

Which is to say that those toiling in the trenches of device integration have some very important work to do. As the 2012 article pointed out, as part of the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009, the federal government has reserved billions of dollars for those facilities and clinicians who demonstrate “meaningful use” of EMR technology to achieve better, safer, and more efficient patient care. And while interoperability itself is not a stated requirement of meaningful use, almost everyone agrees that it’s a critical part of getting there. You can create your

True interoperability on a national scale continues to allude us.
DEFINING ‘INTEROPERABILITY’

The 2012 AAMI publication that grew out of that fall’s Interoperability Summit, Medical Device Interoperability: A Safer Path Forward, noted that the healthcare industry still lacked a common definition of interoperability, and proposed this be addressed immediately. A “priority action,” the report stated, should be to “develop a consensus definition that includes all dimensions of interoperability: data, communications, semantic, workflow, and user interoperability.”

Delving into the issue further, the report quoted Matthew Weinger, a professor of anesthesiology, medical informatics, and medical education at Vanderbilt University School of Medicine who had delivered a presentation at the summit. Interoperability, Weinger said, “is all about communication. It isn’t just the message—it’s the way the message is translated. Most people, when they think about interoperability, are thinking about devices, connectors, hardware, software, connecting devices to health information technology. More important, interoperability means connecting technology to people.”

Later, in April 2013, the Healthcare Information and Management Systems Society (HIMSS) established its own definition of interoperability in healthcare, describing it as “the ability of different information technology systems and software applications to communicate, exchange data, and use the information that has been exchanged. Data exchange schema and standards should permit data to be shared across clinicians, lab, hospital, pharmacy, and patient regardless of the application or application vendor. Interoperability means the ability of health information systems to work together within and across organizational boundaries in order to advance the effective delivery of healthcare for individuals and communities.”

Another definition is provided by the Institute for Electrical and Electronics Engineering (IEEE). Interoperability, the IEEE says, is the “ability of a system or a product to work with other systems or products without special effort on the part of the customer. Interoperability is made possible by the implementation of standards.”

And then there’s this, from Health and Human Services Secretary Sylvia M. Burwell. Last January, when HHS’s Office of the National Coordinator for Health Information Technology (ONC) released its draft interoperability roadmap, she described an interoperable health IT system as one “where information can be collected, shared, and used to improve health, facilitate research, and inform clinical outcomes.”

So, almost four years after AAMI’s 2012 summit, has a consensus definition of interoperability been established? Perhaps—if you’re to follow the ONC, which has decided to go with the IEEE’s definition of the word. Posted on the ONC website: Interoperability is “the ability of systems to exchange and use electronic health information from other systems without special effort on the part of the user. … ONC’s overarching goal for electronic health information exchange is for information to follow a patient where and when it is needed, across organizational, health IT developer and geographic boundaries.” The ONC roadmap itself expands on this: “An interoperable health IT ecosystem makes the right data available to the right people at the right time among disparate products and organizations in a way that can be relied upon and meaningfully used by recipients.” It remains to be seen whether the next version of ONC’s roadmap will further adjust this definition.
networks and connect your cables, gather your devices and install your software, but your finished system had better please your clinicians and their patients and eliminate any potential for medical errors.

**Children’s National Medical Center**

“It’s all about providing great clinical support,” says Simmy Randhawa, nursing director for Clinical Information Systems and Professional Development at Children’s National Medical Center in Washington, DC. “If we’re going to bring a new technology or a new solution into the healthcare environment, it has to be because it makes the clinician’s job easier, and it has to enable better patient care.” The essence of interoperability is ensuring efficiency and effectiveness in “every aspect of flow” Randhawa adds. “You need a seamless process along the entire critical chain.”

Back in 2012, the facility had already realized notable improvements in patient care as a result of its device integration efforts. At the same time, though, Children’s National had been faced with a number of “dead ends,” the sort of unexpected setbacks that lead to late-night handwringing and project leadership wondering what went wrong. The hospital’s original goal, beginning in 2004, was to reduce medication errors. Project team members began by investigating how EMR technology might improve things like nurse documentation and the prescribing process followed by physicians. They’d settled on Cerner for their EMR, were using Cerner I-View to chart vital signs in intensive care, and for the previous four years had been feeding data from a variety of devices in several hospital units directly into the Cerner system. Device integration had, for the most part, been a success, but its scope was limited; those involved in its implementation—people like Jeff Hooper, the facility’s director of clinical engineering—wanted more.

“We definitely went through some struggles to get to that point,” Hooper says. “It took a lot of work.” Since 2012, he says, clinical engineering’s main focus around

---

**It’s All About the Lungs**

**ASL 5000 Breathing Simulator**

**Neonatal-Adult Patients**

Why do patients respond differently to different brands of respiratory equipment? Uncover subtle variations in device performance that impact patient care with the high-fidelity ASL 5000 Breathing Simulator.

Learn more at ingmarmed.com or call 800.583.9910.

To effectively test ventilator performance, you need ventilator-grade lungs.
device integration has been in the area of alarm management. Clinicians had previously used a phone made by Ascom; in 2014 they switched to an Apple iPhone administered by Cerner that comes with a number of applications, including one that can receive alerts from medical devices and others that take in a variety of important patient information for easy viewing by clinicians.

The phone swap was part of a new project launched in 2013 that Children’s National calls the Bear Institute, explains Hooper. The result of a partnership with Cerner, the institute has been billed as the first pediatrics-only health informatics program in the country, and is intended to “advance evidence-based pediatric care delivery, research, and education through innovation in electronic health information technology.” The development of a fully integrated EMR is key to that mission, Hooper says, “and integrating these portable devices that clinicians carry with them everywhere they go was basically our first major goal.” Next up, he adds, is the integration of infusion devices and all that entails, including “medication management and barcode administration and labeling drugs and all of the complexities that are involved in making sure that you can swipe everything and ‘poof’—it all makes its way into the chart.”

A Cerner product called iAware that Children’s National uses in its intensive care units will play a critical role in infusion pump integration as well, Hooper says. “What we have in intensive care are 32-inch LCD displays mounted on the wall, and they’re constantly, dynamically changing. They’re showing vital signs that are trended, hemodynamics that are trended, lab results that are trended, infusions that are trended—so that all a clinician who walks into that room has to

You can create your networks and connect your cables, gather your devices and install your software, but your finished system had better please your clinicians and their patients and eliminate any potential for medical errors.

The themes debated and discussed at the 2012 AAMI/FDA Interoperability Summit remain relevant today. The summit’s seven clarion themes were summarized soon after in the AAMI publication, Medical Device Interoperability: A Safer Path Forward:

• Standardize to achieve success
• Align incentives, expectations, roles, and responsibilities
• Drive patient safety with a systems approach to design and implementation
• Focus on human behavior first
• Improve regulatory clarity
• Streamline clinical workflow to improve return on investment
• Remove barriers with shared, continuous learning

Perhaps most important, the summit’s participants had reached the consensus that when it comes to achieving interoperability, “human and organizational challenges are actually more significant than any technical obstacles.” Progress in the world of interoperable healthcare systems was primarily impeded by things like “uneven leadership; limited cooperation, collaboration, and expertise; and inconsistent clinical workflow,” the report noted, and it pointed to one facility—Oklahoma Heart Hospital—as a great example of what organizations could do when all of those factors were addressed head-on. To minimize the frequency of IV medication errors and other adverse drug events, Oklahoma Heart had gone live with an all-digital, interoperable infusion-device system in February 2012. And while the process necessitated working through a slew of difficult technical issues, those issues were overcome, the report said, through “collaboration with critical players including analysts, clinical educators, and vendors, as well as biomedical, nursing, pharmaceutical, and network engineering staff.”
do is look up and they can see all of that aggregated information together on one screen.” Right now, Hooper says, nurses working with infusion pumps must type that information into the system themselves. It’s all in the electronic medical record, but it’s not easily accessible. “In the future”—2016 is the goal—“it will all be a continuous, automatic process.”

This new approach to integration, Randhawa agrees, will “leverage more of a push mindset versus a pull. Right now we have to go into the record—we have to go get the data.” The new set-up will “push information to us when we need it, and it will be relevant clinical information that will help us provide better care for our patients.” That interoperability, Randhawa adds, improves the safety of the overall system. “When devices are kept in silos, we introduce more risk”—something might happen in one aspect of care that you might not catch if you’re focused on something else. “But when devices are working together, that not only improves efficiency, it also gives us this clear picture of what’s happening along the entire clinical chain.”

The hospital’s new phone system, which uses an application called CareAware Connect to bring together communications, alarm management, and nursing workflow tools on a single portable device, offers similar interoperability-related improvements, Randhawa says. “Actually, the possibilities seem endless both for improving communication and for improving patient care.” The system allows for voice calls, secure text messaging between clinicians, and easy EHR access, all through the facility’s existing wireless infrastructure.

A challenge, Randhawa says, has been keeping up with the phone itself. “You have iOS operating upgrades and software upgrades and then the Connect solution also requires upgrades—so the trick is getting to that place where you have a good maintenance plan. When you’re dealing with software solutions that are constantly changing and improving and evolving, you have to have strong support to ensure sustainability and stability.” Things have been made easier, she says, through significant behind-the-scenes work with the Bear Institute team “to make sure everything is flowing—that the data flow through the middleware is correct and that everything is configured accurately.”

From his vantage point in clinical engineering, Hooper says, the biggest challenge related to interoperability has been moving past the “siloed ownership” style of support, where a technology or a device or even a functionality is maintained by one individual or department within the organization. Previously, “if a ventilator didn’t work, we could replace that ventilator with another ventilator, or maybe troubleshoot it individually because it didn’t impact more than one patient.” The reality now is that “all these pieces of equipment are tied together, so anything you do might impact the whole network.” With integration at the facility proceeding as it has, he says, “there might be at any given failure point six or seven different teams involved in troubleshooting why the entire system doesn’t flow the way it’s supposed to.”

“Interoperability Lessons Learned: UF Health Shands Hospital

1. Planning pays off.
2. Adaptability is mandatory.
3. Implement in an order that fits your organization.
4. Test.
5. Don’t move to the next item/project until the current one is working/successful.

“It’s like cable television. When you turn on your TV at home, you expect the cable to come on, even though you may have no idea how the computers and servers and cables behind it actually work. That’s kind of the environment that our clinicians are in—they just expect things to turn on and do what they’re supposed to do.”

— Jeff Hooper, director of clinical engineering, Children’s National Medical Center in Washington, D.C.
Clinical engineering’s role “is to make sure that the information from the medical devices gets to the Cerner application.” Once there, “that data is shot off to another set of computers and servers,” which is Cerner’s responsibility, “and then it goes to yet another entity that manages the integration to the actual phone.” When an issue comes up, the various teams troubleshoot using “bridgelines” established through a new IT help desk. “We kind of struggled at first to equip them with all the tools they needed to understand what could go wrong,” Hooper recalls, “but now it works great—that desk acts like a single funnel point and everything goes through them.” Their job, he adds, is “to look at the puzzle and figure out what the issue is: Is it networking? Is it a clinical application issue? Is it a password problem? Or maybe it has something to do with the actual phone.”

If that troubleshooting process reveals a problem that is clinical engineering’s responsibility, Hooper says, “we’ll go off and try to fix it, make sure it looks good on our end,” and then it’s on to the next team down the line to ensure that data is “flowing again.” This process has typically been disruptive for clinicians, he says. “If someone told us an alert for a code blue didn’t make it all the way through to an end user’s phone, the only way that we used to have to test that was to set off a code blue and then follow it across the network until it reached the server.” If the problem spot was found, it would be fixed. And if it wasn’t, “we’d literally be setting off code blues every 15 minutes all day long until we figured out what was wrong.” Today, Hooper says, clinical engineering is working with IT, outside vendors, and others to create an “a-to-z nonproduction environment” where problems can be solved without disrupting workflow.

Interoperability, adds Hooper, has turned the old world of “something breaks, clinical engineering or IT fixes it,” into something much more cyclical, “where once you’re going, it just doesn’t stop.” Now, he notes, almost every area within the Children’s National system is either on the EMR or soon will be, and that has created a new sense of urgency when a device goes down. “Now you have to think about the entire clinical workflow.” A technical problem that might have seemed simple and unremarkable in the past, that is, could now prove critical to patient care. “People are depending on interoperability to work,” he says. “That has really changed how we do our job.”

**Shands Hospital**

Increasing interoperability has had a similar effect on the Clinical Engineering Department at the University of Florida’s Shands Hospital in Gainesville, says Department Director Craig Bakuzonis. Back in 2012, Bakuzonis explained how Shands had successfully integrated data from nearly 600 bedside monitors into a new EMR system with relatively few hitches. (The key to success then, he said, was their decision to use HL7 as their data interchange standard; once they’d done that, they purchased technology that met that standard.) There would be more work ahead, he predicted, but he also seemed confident that his team could handle whatever challenges it faced.

As it turns out, he was right. One of those challenges—and a problem they had already begun to think about in 2012—involved addressing the 30-parameter limit that came with the HL7 export engine they had in place for their anesthesia information system. Their solution, Bakuzonis says, was to switch device integration vendors, a move that in one fell swoop “allowed us to add parameters for other devices like cerebral oximeters, continuous cardiac output, and a more-current bispectral index.”

From there, he recalls, they moved on to dialysis, where technical issues with device configuration made the process “a little less smooth.” The lesson learned there, Bakuzonis says, was “even when it seems like you’ve done everything right, and the tools you use for testing say it’s all been done right, it still may...
not work. And when that happens, the only thing to do is to just start all over.” Bakuzonis still doesn’t know exactly what went wrong, but that doesn’t concern him: “We can’t identify what happened or how it happened; we just know that everything worked the second time around and since then there have been no issues.”

Overall, Bakuzonis says, he and his colleagues have been “making strides” toward general interoperability. But he also feels there’s a lot of work ahead—both on the device integration front (like “dealing with the standalone devices in our intensive care areas”) and, inevitably, in the realm of challenges that will likely arise as the facility expands over the next several years. “From my perspective, the main way this whole process has evolved has been in the way it has gone from being our job in clinical engineering to something now seen as a systemwide initiative under information services.” Clinical engineering’s focus going forward will be continuing to interface at the device level, he says—“ensuring that each device is configured correctly for its data export needs.” He calls his department’s close relationship with information services a “partnership,” noting there are “five or six core people within this group that run the implementations over and over again.” And one of those people, Bakuzonis says, is Pedro Hernandez, an application support analyst who in 2012 was in charge of mapping parameters into the Epic system.

Since then, Hernandez says his main challenge has involved networking. As more devices are connected to the EMR, “there is much more data coming across the pipe, so we have to make adjustments in our wired and wireless networking infrastructures”—by isolating channels dedicated to such data, for example VLANs—to handle more data throughput.” Working on the frontlines of Shands’ run toward interoperability has taught Hernandez valuable and critical lessons. Teamwork and effective project management is important. “You have to get all the teams involved and then run like a train. From front to back, everybody’s got to be heading in the same direction.”

Bakuzonis agrees that the work they’ve completed to date at Shands has been far from easy. “It’s certainly not just plug and play. You’re never just hooking up a device and then walking away; there’s teamwork required every step of the way, and there’s a lot that goes on behind the scenes.” This is probably the case for any facility where device integration is a major objective, he says. “But you get the right people to do the job, and you figure it out.”

University of Iowa Health Care
One of the biggest issues around interoperability, says Tim Vanderveen, vice president of the Center for Safety and Clinical

“There’s more work ahead to get patient data into medical devices and electronic medical records.

“You have to get all the teams involved and then run like a train. From front to back, everybody’s got to be heading in the same direction.”

— Pedro Hernandez, an application support analyst at University of Florida’s Shands Hospital in Gainesville, FL
Excellence at CareFusion, is that “a lot of institutions don’t want to be first.” Take, for example, the challenges associated with “smart” infusion pumps, which CareFusion has offered since 2002. When a smart pump is integrated with the EMR, Vanderveen says, “you get real-time documentation of the entire infusion process.” And yet, he notes, most facilities “are not yet ready” to do what it takes to make pump integration a reality. “There are so many demands on IT departments that it’s just not a priority. Then, to make it happen, it has to be a coordinated effort between pharmacy, nursing, IT, and your physicians, and you need project managers and somebody to pay for it.” Furthermore, he says, a facility’s wireless infrastructure must be able to handle the system so that workflow is improved—and not impeded. “Nurses are not going to sit there and wait for 30 to 60 seconds just for a program to open. If it doesn’t run smoothly, they’ll just be frustrated.” Complicating things even further, Vanderveen says, is the fact that “infusion pumps and HIT systems were created in silos, so tying them together is no slam dunk.”

That, in fact, was exactly the experience at University of Iowa Health Care (UIHC), where Jeff Killeen, PharmD, manager of pharmacy informatics, has helped lead the organization’s charge toward interoperability since it installed its first smart pumps in 2008. The main challenge, he says, involved working with their vendors (CareFusion Alaris and Epic) to coordinate the various components of the system. “We talked to them both over the years, and basically said, ‘Hey—this is a no-brainer: You guys have this information in this system, and we need to get it into this system over here; and then you guys have the information about what happened, and we need to get it back into that system over there.’” Sure, he recalls, it might have been complicated. But these were tech companies—they should be able to do it. “All we wanted was transparency and visibility across the systems so that we wouldn’t necessarily have to be at the pump to see what was happening.”

Eventually, Killeen says, their vendors came around, and in 2013 they finally committed to working with UIHC to establish a pilot program. After that, he recalls, “things went fairly quickly—maybe nine or ten months before everything was up and running.” Getting to that point was not all smooth sailing, however. “A project like this is a huge commitment,” Killeen says. “You need a lot of people from all over the hospital to coordinate their time and do a lot of work behind the scenes.” The UIHC effort included critical backing from the facility’s chief medical informatics officer, chief nursing officer, and chief pharmacy officer, he says, and was pulled off by a “highly multidisciplinary” team composed of individuals from each of those groups, as well as biomed and IT.

Still, Killeen says, as far as he can tell, the work has been worth it. “Based on the success of our go-live”— which took place in February 2014—“and how things have turned out since, I’m happy with it.” Smart pump integration has both facilitated workflow and helped the facility’s patients, he says. “You know, it’s been great for us because it’s more efficient, but obviously, the real reason you do something like this is to improve patient safety, and we’ve seen that as well.” In fact, he notes, “now that the EMR is programming the pump, we don’t see those touchpad errors where you hit one too many zeros, or any of those human errors related to mis-programming.” It’s been a win-win program from start to finish, he says. “It’s made IV administration a very safe process.”

“There are so many demands on IT departments that it’s just not a priority. Then, to make it happen, it has to be a coordinated effort between pharmacy, nursing, IT, and your physicians, and you need project managers and somebody to pay for it.”

— Tim Vanderveen, vice president of the Center for Safety and Clinical Excellence at CareFusion, about smart pump integration with EMRs