Achieving Data Liquidity Across Health Care Requires a Technical Architecture

by Kerry McDermott

EDITOR'S SUMMARY

While data is recognized as key to individual and wide-scale healthcare improvement, the absence of interoperability among supporting technologies obstructs progress. There is no single technical architecture that links medical information systems, such as electronic health records and medical devices, to enable seamless data flow. The lack of a consistent platform undermines patient outcomes and efficiency and increases cost and complexity. An interoperable technical architecture is the basis for data liquidity and the efficiencies it can deliver. Such a platform must use a standards-based interface and support plug-and-play integration, one-to-many communication and real-time two-way data exchange. The Center for Medical Interoperability advocates for and leads research in developing the architecture for a vendor-neutral platform. Healthcare systems must exert pressure through the procurement process for vendors to develop compatible systems.

KEYWORDS

interoperability

standards

information technology
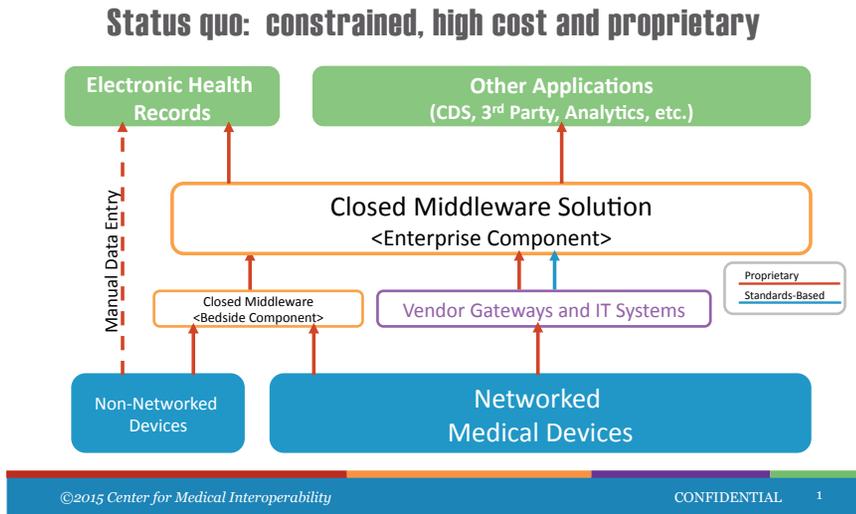
medical informatics

electronic data interchange

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We know that data-driven insights are essential to improving care at the individual and population levels. We know that technology ought to function seamlessly in the background, helping clinicians excel in their jobs and achieve the best possible outcomes for patients. We know that we are not on a logistically or financially sustainable path to care for generations to come. We need to repair the technical architecture supporting health care such that we have a solid foundation upon which to innovate and develop solutions that will transform care for our nation.

Current State Challenge

The absence of an architecture for connecting the technologies and applications used across the continuum of care leaves the vast majority of medical devices, electronic health records (EHRs) and other IT systems unable to exchange information with ease at an affordable cost. Various systems and equipment are typically purchased from different manufacturers, and each comes with its own proprietary interface technology. This lack of interoperability means hospitals have to spend scarce time and money setting up each technology in a different way, instead of being able to rely on a consistent means for connectivity. Furthermore, hospitals are usually forced to invest in separate "middleware" systems to pull together all the disparate pieces of technology to feed data from bedside devices to EHRs, data warehouses and other applications that aid in clinical decision-making, research, analytics and consumer engagement. Many, especially older, devices don't even connect; they require manual reading and data entry. The nation's largest health systems employ thousands of people dedicated to dealing with this challenge. Figure 1 depicts the current state of data flow.

FIGURE 1. Current dataflow in healthcare systems

Status quo: constrained, high cost and proprietary

Electronic Health Records

Other Applications (CDS, 3rd Party, Analytics, etc.)

Manual Data Entry

Closed Middleware Solution <Enterprise Component>

Proprietary
Standards-Based

Closed Middleware <Bedside Component>

Vendor Gateways and IT Systems

Non-Networked Devices

Networked Medical Devices

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Data liquidity is predicated on interoperability – the ability to seamlessly share and use information across multiple technologies and settings – and we cannot achieve it without a blueprint for how the pieces work together. The current lack of interoperability can compromise patient safety, undermine care quality and outcomes, contribute to clinician fatigue and waste billions of dollars a year. It also hinders progress toward achieving goals for population health management and precision medicine. Worse yet, it impedes innovation, which may be the biggest missed opportunity for health care.

By contrast, the seamless exchange of information would improve care, increase operational efficiency and lower costs. It would facilitate care coordination, enable informatics and advanced analytics, reduce clinician workload and increase the return on existing technologies. To realize these benefits, health systems must rethink how to connect the disparate pieces involved in end-to-end patient care both within and across care settings.

Future State Architecture

Rather than the constrained, high-cost, proprietary status quo, health systems must demand and adopt a platform that enables plug-and-play integration of devices and systems, addresses one-to-many communication, allows two-way data exchange in real time and is standards-based. Let's explore these attributes.

Plug-and-play means that when two independent pieces are connected, they self-configure and can talk to each other without (or with minimal) human intervention. For example, an ATM card can be used in any ATM around the globe.

One-to-many refers to the need for one device or system to communicate with multiple others, sometimes at the same time. For example, data elements that are critically important to the safety of care and patient outcomes, such as patient allergies, are manually entered and re-entered even on the same inpatient or outpatient visit. Ideally, the data would be entered once and automatically shared with various systems, making it available to any care team and avoiding potential mistakes from delayed data entry. This capability, combined with real-time, two-way communication, would improve workflow by automating tasks as appropriate and ensuring that needed information is readily available – all with appropriate levels of privacy and security.

Two-way data exchange is the backbone of a learning health system. Patient care technologies need to be able to send and receive data in a manner that enables feedback loops and automation. When connections are one way, information doesn't always reach the destination where it is needed and it often places the onus on individuals to detect problems. In some cars, for example, sensors are able to communicate with brakes and automatically intervene to prevent crashes. The lack of such information exchange in health care frustrates efforts to apply advanced informatics and improve clinical workflow and care delivery through automation.

The use of open, standards-based interfaces, as opposed to proprietary interfaces, for gaining access to data from multiple sources will reduce costs to all by decreasing the number of interfaces that are built and maintained. A platform with these attributes would give a health system or provider

FIGURE 2. Conceptual architecture to insure data liquidity

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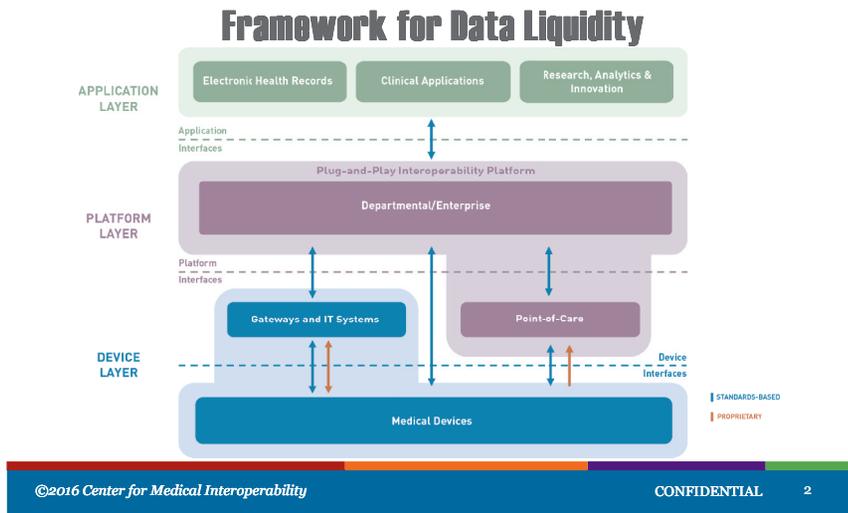
greater control over the data it needs to deliver safe, efficient and effective care. A conceptual architecture is pictured in Figure 2.

A key feature of the platform illustrated above is that it makes it possible to scale interoperability. It provides a blueprint for how the various technologies used in patient care can plug into a health system's operations. The use of standards-based interfaces levels the playing field and reduces barriers to entry for those trying to innovate in health care. The platform connects data producers with data consumers. If a vendor can certify that its product works with the platform, the product will be interoperable with any other system already connected to the platform. In health care, this is essential to enabling data liquidity.

Imagine having the equivalent of an air traffic control system for healthcare data. Air traffic control is a routing function and is performed agnostic to, but with full understanding of, airline, size and model of plane, flight origination and destination, type of cargo and so forth. Air traffic

control follows the same protocols each time a plane lands or takes off. The notion of a non-standardized approach strikes us as preposterous for something as safety-critical as air traffic control, yet it's how we operate in health care.

Health Systems Unite to Solve Technical Challenges

The vision of accelerating the seamless exchange of information to improve health care for all guides the Center for Medical Interoperability. The Center is a 501(c)(3) organization led by health systems to change how medical technologies work together. Despite their shared technical challenges, they heretofore lacked a place to work on them. As a cooperative R&D arm for health systems, the center provides a vendor-neutral focal point for solutions providers to engage their customers. Its work is technical in nature, and its engineers are collaborating with industry stakeholders to develop the architecture for a vendor-neutral platform that will make it easier and less expensive to access and use the data from technologies across the continuum of care. This improvement will enable health systems to have real-time patient records that are complete and consistent and gain greater control over the data needed to deliver safe, efficient and effective care. The center is also establishing a centralized lab to test and certify that devices and enterprise applications meet members' technical requirements, thereby giving health systems confidence that the solutions purchased for patient care will work as expected, safely and securely.

Compelling Change with Procurement Power

Redefining the architecture for health care is no small task – and impossible for any single system. The procurement process is an effective lever for this magnitude of change. As the organizations buying, implementing and using technologies to care for patients, health systems can and must transform the technical underpinnings of the healthcare industry. Purchasers can reward vendors and developers that work together to adhere to the architecture.

The unified voice of health systems making consistent requests of vendors would benefit purchasers and sellers alike. The need to create and support

customized solutions often is a financial burden on vendors as well. A centralized approach to establishing requirements can overcome the inability of a single health system to compel change on its own. Requirements should be specified in requests for proposals (RFPs) and upheld in contracting language. If you get what you pay for, then health systems ought to change what they pay for.

For the vendor community, a centralized approach provides a focal point for engaging customers in solving shared technical challenges. It also makes enlisting the help of other industries easier. Breaking legacy thinking is one of the hardest, yet most critical, aspects to revamping data flow in health care.

Learning from those industries that have conquered similar challenges is invaluable.

It's Time To Act

We must address the technical underpinnings of U.S. health care to enable the same data liquidity that we enjoy in other aspects of life. The healthcare ecosystem is poised to come together and drive change. Patients deserve better outcomes and care experiences, healthcare professionals deserve technology that helps them excel in their jobs, and our nation deserves a sustainable health system to care for generations to come. ∎